THIS WEEK'S NATIONAL PETROLEUM NEWS

The Recognized Authority on News, Markets and Technical Developments in the Oil Industry

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Coming Meetings

Nebraska Petroleum Marketers, Inc., Paxton Hotel, Omaha, Nebr., Dec. 3, 4, 5.

1936

Wisconsin Petroleum Association, Plankinton Hotel, Milwaukee, Wis., Jan. 7, 8, 9 .

Northwest Petroleum Association, North Dakota division, Waldorf Hotel, Fargo, N. D., Jan. 13, 14.

Northwest Petroleum Assoc., Minnesota division, Ryan Hotel, St. Paul, Jan. 16 and 17.

Kentucky Petroleum Marketers Association, 10th annual meeting, Brown Hotel, Louisville, Ky., Feb. 5, 6.

Ohio Petroleum Marketers Association, Hotel Deshler-Wallick, Columbus, Ohio, Feb. 25, 26, 27.

Oil Men's Association of New England, Boston, Mass., Mar. 11, 12.

American Association of Petroleum Geologists, annual meeting, Tulsa, Mar. 19, 20, 21.

American Chemical Society, Petroleum Division, Kansas City, Mo., Apr. 13 to 17.

National Petroleum Association, Cleveland Hotel, Cleveland, O., Apr. 16, 17, 18.

Natural Gasoline Association of America, Mayo Hotel, Tulsa, Okla., May 13, 14, 15.

International Petroleum Exposition and Congress, Tulsa, Okla., May 16 to 23.

Pennsylvania Grade Crude Oil Assn., 13th annual meeting, State College, Pa., June 18, 19.

American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 20 to July 3.

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M. P. Youker

M. P. Youker, vice-president of Phillips Petroleum Co. in charge of refining activities, has been one of the pioneers in the development of thermal polymerization processes. One unit using his process has been in commercial operation for two years or more at the Phillips refinery in Borger, Texas.

Polymerization is not the first contribution of Mr. Youker to refinery technology. While with the U. S. Bureau of Mines more than a decade ago Mr. Youker experimented with bubble towers as used in the alcohol industry for crude fractionation. At the 1924 International Petroleum Exposition in Tulsa he demonstrated a pilot size refinery using the bubble tower.

Shortly afterwards Mr. Youker resigned to become head of refining for the Waite Phillips Co. and built his ideas into full scale distillation units. After Phillips properties were sold to Barnsdall Mr. Youker withdrew from the Barnsdall organization and, with O. L. Cordell and R. B. Pringle, organized the Alamo Refining Co. and built the Borger refinery which later was sold to Phillips Petroleum Co. Since this sale in October, 1927, Mr. Youker has been at the head of Phillips refining operations.

NATIONAL PETROLEUM NEWS

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Downtown Des Moines Stations Give Rebates But Neighborhood Dealers Stand Pat

By E. L. Barringer
N. P. N. Staff Writer

DES MOINES

REPORTS and rumors of under-the-canopy price cutting at service stations in Iowa, attributed to failure of retailers to control their markets, have been prevalent since major companies withdrew from station operations when the chain store tax became effective some months ago.

To gain first hand information on this situation, NATIONAL PETROLEUM NEWS recently conducted its own survey at Des Moines service stations to determine if discounts were being given on gasoline and oil purchases.

Preliminary conversations on the Des Moines market situation indicated there would be no difficulty in finding station discounting. In fact, one marketer estimated that at least 50 per cent of all outlets in the city were offering some kind of price inducement, plain or fancy, on gasoline.

NATIONAL PETROLEUM NEWS' survey indicated that price cutting is prevalent in the highly competitive area near the main business district. Residential district stations, however, will not cut prices.

Within a short distance in a highly competitive area 50 per cent of the stations visited quickly offered a price inducement on gasoline. These were not open cut price stations. Two stations handling private brands, at a reduced posted price, were visited, one offering a discount the other standing pat on the posted price.

In some measure the one-cent discounts offered in this highly competitive area may be explained by a difference in posted prices. Most stations posted regular gasoline at 17.3 cents. One station, handling a national brand, posts its price at 16.3 cents.

While some retailers are offering a 1-cent discount, and thereby reducing their gross margin to 2.5 cents, their actual price under these circumstances is on a par with the station posting the 16.3-cent price.

In a residential section an entirely different situation was encountered. Only one station operator intimated that a price reduction might be negotiated, and this upon consultation with the partner.

Further inquiries showed that posted prices generally are firm in residential districts. These stations are dependent upon neighborhood business, the type of customer reluctant to shop around for a bargain. It was acknowledged that probably some neighborhood gasoline business had flowed to the highly competitive business district stations, on account of secret discounts, but the volume was not sufficient to worry residential community retailers.

NATIONAL PETROLEUM NEWS' survey was conducted in an automobile bearing Iowa license plates. Upon driving to the pump island the dealer was told a "story" about the driver being a salesman, just moving into the state to headquarters out of Des Moines for several months. All the business of the "salesman" was offered to the station if a discount could be obtained on gasoline.

If pressed for an estimate of gasoline volume the driver thought the business would amount to 25 to 50 gallons a week, but all sales, however, were to be cash, not on credit.

Some of the experiences at these stations in the highly competitive area follow: All products involved are from major companies, unless otherwise noted.

The first call was quite discouraging. The salesman really tried to unsell the shopper on chiseling. This was a company operated station, one of the few in the state, and a blunt "No" was the answer to the discount request.

"What the hell, you're a salesman, do you want to give

away part of your profits?" the station salesman asked.

"Yes, but you are making plenty of profit on gasoline," we challenged.

"Not at 3.5 cents a gallon," was the prompt reply.

The second station was more encouraging. The salesman called over the other man on duty, evidently a partner, and after a few minutes figuring the shopper was offered 1 cent off the 17.3-cent regular grade price.

A good bargain was driven on oil here. On drains a nationally known 30-cent oil could be shaved to 20 cents a quart. Finally, as a clincher, the salesmen offered to throw in the grease job at 75 cents, against the regular $1 price.

The man on duty at another station, where regular gasoline was posted at 17.3 cents, did not know if a discount could be obtained, but he advised returning in the evening when the owner would be on duty.

At the first of two price selling, private brand stations visited posted prices were 13.9 and 14.9 cents. The owner promptly turned down the request for a discount. "We are as low now as we can go," he explained.

A nearby major company brand retailer also refused a discount, on gasoline, oil or lubrication service. The shopper, however, was invited to patronize the station if no discount could be obtained.

"We give lots of service and would be glad to have your business," was the salesman's parting remark.

The boy on duty at another major brand station was confident the "boss" would knock off 1 cent from the 17.3-cent regular grade price, also 5 cents a quart on oil. The shopper was asked to return later to see the "boss" and maybe the truckers price of 2 cents off would be given, but he was not to mention that the boy had suggested such a big discount.

The second price seller, private brand station, offered a real buy. The "high test" 17.3 cent price could not be shaved. The 13.9 cent price on "regular" was subject to a 2-cent discount. On oil the shopper could get a drain on the 20-cent oil and pay only 12.5 cents a quart. Many coal trucks patronized the station and found the gasoline and oil quite satisfactory, the shopper was told.

Then came a station handling another famous brand. Quite promptly the regular 17.3-cent price was cut by 1.5 cents, the 15.3 cent third grade gasoline cut by 1 cent. The refiner's best oil brand was knocked down 5 cents a quart.

A peculiar oil bargain was offered at another station. This was on a national brand, 35-cent oil. On drains the price could be shaved 5 cents a quart, but only 3 cents on add-a-quart sales. Regular 17.3 cent gasoline could be obtained at 1 cent off.

Posted prices on regular grade at these stations was 17.3 cents. Third grade posted prices ranged from 14.9 to 15.3 cents. While some stations in this highly competitive area visited readily offered secret discounts, the station charged with forcing such competition was farther away from the business district, yet on the same main thoroughfare, and on a main tourist traffic route through the city.

THIS station posts a 16.3-cent price on a nationally advertised grade of regular, and announces the price on a home-made sign fastened to a lamp post at the curb. But the 16.3 cent price was subject to a 0.3-cent cut, offered rather reluctantly when the shopper was not ready to accept the proposition that 16.3 cents was the bottom of the retail market.

In the residential district posted prices were quite firm. The shopper made the same inquiries, and as in the highly competitive area but only one station salesman intimated a discount was possible. The shopper was asked to return in the evening when both partners would consider the proposition.

Oil prices, however, were subject to shading through the 5-gallon can purchase plan. Station salesmen suggested that, while gasoline was sold at the full price, oil could be purchased at a material saving in a case or five-gallon can lot. The oil would be kept in the station, and served to the car as needed, and the savings would amount to about 11 cents a quart.

The salesman at a station on the border between the business and residential section smothered the shopper with politeness. After explaining that high rent and labor costs prevented giving a gasoline discount the salesman related how the manager also had turned down a creamery account operating 36 trucks.

"Anyway, thank you for coming in," was the salesman's cheery farewell.

Wilshire Asks Damages For Loss of Dealers

LOS ANGELES, Nov. 18.—The Wilshire Oil Co. filed suit in state superior court here Saturday against the signatories to the Pacific Coast Petroleum Agency charging violation of the Sherman Anti-Trust law and the Clayton Act and the state Cartwright Anti-Trust Act, claiming $7,500,000 damages.

The complainant alleged that the defendants through the agency, obtained control of 95% of the sources of supply of gasoline in the state and then agreed among themselves on Nov. 16, 1934, to refuse to sell gasoline to any service station handling complainants "Economy" brand gasoline.

It was further alleged that between Nov. 16 and Dec. 10, 1934, that by the aforementioned means, the defendants succeeded in alienating about 855 service stations formerly served by the complainant. Similar illegal operations were asserted in Oregon, Washington, Nevada, and Arizona.

New Committee Chairman

NEW YORK—A. W. Thompson, Mandeville & Thompson, Houston, Texas, has been appointed chairman of the American Petroleum Institute's Southwestern district subcommittee of the committee on standardization of rotary drilling equipment.

The Editor's Viewpoint

Industry Can Stand on A. P. I. Platform

By Warren C. Platt, *Editor*

THE forceful declarations at the meeting of the American Petroleum Institute at Los Angeles last week of no more government interference with the oil industry than is necessary for the states to enforce true conservation of our natural resources, should meet the approval of every oil man. So far we have not heard one objector to this position.

The presentation by President Byles in his annual address and of the report of the board of directors showing the extent of today's petroleum resources and the confidence that the public can have in the ability of the industry to take care of its needs probably long past the time when there may be internal combustion engines, was direct, frank and convincing.

From the official expressions and from those heard privately the oil industry does not want any more government contact than is necessary to carry out existing laws; the oil industry does not need any more federal government interference than it now has; the states are doing their job and doing it better every month and there is more hope for California getting its own domestic affairs in line than ever before. Oil men at the meeting had more hope and confidence in their own future and in that of their state governments than they have had for years.

This was in great contrast to a year ago when at Dallas the then Oil Dictator Ickes let loose a blast of unfair and untruthful statements in his effort to put the oil industry under his dictatorial and incompetent control. While the industry officially waited long, the Los Angeles meeting at last was a good answer to all the falsehoods that Ickes has uttered and to his threats against the industry.

There was considerable comment during the meeting over a story published in Los Angeles from Washington which just seemed to ooze with honey toward the oil men; they have nothing to fear; the President just loves them and never did have the slightest idea of interfering with the industry, etc. The thing read like a "plant" to try and lull the oil industry to sleep. It gave a little more edge to the story carried to the Dallas meeting of the Independent Petroleum Oil Association two weeks before by a henchman of M. L. Benedum, Pittsburgh oil man, which purported to be an approved statement from President Roosevelt and which was supposed to calm the troubled waters of the oil industry and cause all oil men to rest in peace and have every faith in the kind intentions of the Roosevelt administration. That statement, however, had concealed in it and none too cleverly, the threat that if the industry did not do thus and so instanter then this all-wise but all-grasping administration would take charge.

The record of this administration at Washington is such that the oil industry cannot trust it as far as it can be seen. There are too many kinds of animals in it who are hungry for power regardless. We undoubtedly will be assailed by unfair and unwarranted legislation at Washington by this coming winter's session of Congress. The statements of President Byles and of the directors of the A.P.I. are ones that the industry can well and safely stand on in meeting these attacks.

Marketing Still an Unsolved Problem

WHAT has always been missing from the American Petroleum Institute and what was particularly missing at its big and most interesting meeting last week at Los Angeles, is a good strong representation of real Independent jobbers. Had there been such representation all these years the course of oil marketing undoubtedly would have been far different than it has been. A strong and constructive protesting group certainly would have prevented the industry getting into quite such a marketing mess as it is at the present time.

That is not too strong a statement because the Independent jobber as a class is interested in marketing quality goods at a profit but at the lowest of efficient marketing costs. His interest is diametrically opposed to that of the big companies in the sale of crude oil as gasoline, in the recouping of marketing losses from production and, in case, from pipeline and refining profits.

But in marketing alone the interest of the jobber is exactly that which the big companies should have—profit in marketing. If the big companies would divorce their production, pipe-

line and refining profits from their marketing and let that last department stand on its own feet in competition with the Independent jobber their marketing departments would be tremendously efficient. They would have to be in order to stand up against the jobber who owns his own business and operates in such small units that he personally is supervising all the details.

It is fair enough to conjecture that had this been true all these years we would not have had the large number of retail outlets in gasoline marketing we now have, nor the number of professional price cutters nor co-operative oil companies. Price wars would not be as drastic and there would not be the whoop and hurrah from some government quarters to take over the oil business, at least the excuse would be much poorer than it is now.

AT LOS ANGELES last week there was no organized jobber representation and the discussion of the proposed new code was most perfunctory, consisting no more than just its presentation. A few jobbers were present, presumably waiting to hear if the A.P.I.'s code committee had anything to say on the jobbers' platform adopted at Chicago two weeks before to the effect that the majors should put their marketing departments on their own profit and loss basis and thus compete with the jobber on the same level.

Then, as usual, the election of the board of directors of the A.P.I. proceeded without any recognition of the Independent jobber. Election to the board does not mean much these days because the board has been enlarged so many times and because it has retained in its membership men who for years have had no connection with the oil business. Still every one likes to get on it. It is the only means of the Institute to formally recognize different groups within the industry.

Various groups in refining and producing are on the board particularly the group of producers who, more than most any other, had to do with getting crude oil put up to $1 a barrel at the start of the code two years ago.

This is as it should be. The Institute should include all the legitimate groups within the industry. Only then can the Institute be the real factor that it should be. The only place where the Institute has been weak has been in marketing. When the jobbers had a national organization in past years that was recognized by the election of its president to the board of the Institute but after L. V. Nicholas retired from the presidency of the jobbers association and that organization promptly went to pot, there has been no jobber on the Institute's board. However it should not be necessary for the jobber to have a national organization to be on the Institute's board because there are many strong state associations whose presidents are entitled to a place on the board.

The fault is primarily with the jobber because he has not organized and fought for a place on the board but it also lies with the major companies who have been so busy jockeying so many candidates from their own list of officers who want recognition that by the time they crowd on there is no room for any one else. The result is that, so far as marketing is concerned, the board is top heavy with the majors, which causes the jobber to feel that he has been snubbed and to stay away.

The jobber felt somewhat the same way, and justly too, about the late and unlamented P. & C. Committee and he feels the same way also about the means used to develop the present proposed oil code. The jobber has been merely an afterthought. Since he began to fight back for principles that he feels sound and which are most sound, and since a few windows have been broken, there has been considerable scurrying around with expressions of solicitude on his behalf. Prior to that he was going to have to take it and like it.

The politics of working with the jobber has been bad, very bad and yet numerically and politically he is more powerful than the majors. He is down to the grass roots of the voters of this country, he lives and eats and plays with them while the big company officials necessarily can only view the voters from a distance.

THE application of the chain store tax to filling stations in Iowa and Indiana was nothing but jobber retaliation and the jobber succeeded despite the efforts of the majors to the contrary. The investigations of the industry in Michigan and Wisconsin have been put over by the jobber against the vigorous opposition of the majors.

The Department of Justice at Washington is looking into the oil industry today at the request of the jobber.

It should therefore appear reasonable that some intelligent consideration and representation in the councils of the industry should be given the jobber. It is useless to damn him as a price cutter as he is no more of a price cutter than the major companies are. It is not true to say that all he wants is more margin guaranteed by his sources of supply. Any one listening to meetings of jobbers and talking to them privately, I mean the worth while legitimate ones, hears nothing but condemnation of today's margins which invite the price cutter to give 2 cents off, prompt the dealer with small gallonage at best to concede 2 cents and provides the co-op. with his big talking point of being able to show a "saving" to his "patrons" of 2 cents a gallon.

Above all the wide margin permits the major companies to get a large part of the truck gallonage by giving their dealers a margin they can cut while the majors at their company owned and operated stations keep a straight and solemn face as they piously intone the creed of the code of no price cutting. These majors also have this national discount business which is not what some people call exactly fair nor ethical.

All the jobber is asking for, as we hear his protests, is that the majors put their marketing on a sound and sensible business basis and then

let the jobbers compete with them on the same basis. If this means the end of guaranteed margins and controlled retail price all well and good. But whatever margin the majors require not only now but eventually to profitably market upon, let the jobber enjoy the same margin by his own efforts and he will be satisfied, as he knows from years of experience that he can operate generally cheaper than the majors can.

Los Angeles last week was an ideal place to thrash out the marketing situation in the discussion of the proposed new code. It is sincerely to be regretted that the political situation within the industry was such that the industry did not avail itself of that opportunity. The jobbers could have presented his contentions before the big executives of the industry, and they should have seen to it that they were at that marketing session because the marketing mess today calls for their undivided attention for a few weeks at least. A few wells more or less in production matter little compared with all the money the majors are losing in marketing and compared with the most unfavorable political material which is fast being developed against them in these state investigations.

Marketing is the big unsolved problem of the oil industry today and the failure to solve that will have more to do in a practical way with provoking attempts at government interference with oil than most any other branch of the business. Marketing therefore deserves the undivided attention of the highest executives of each major company. Their subordinates have not solved the problem so it is high time that they took a hand.

The new jobbers' association organized at Chicago the other week should be welcomed by these executives because it affords a central means of working with the jobber whereas, before, the majors would have had to cause a central committee to be organized or deal with more than a score of individual jobbers' organizations. The new national jobbers' organization is strong, and well representative in membership of the legitimate and conservative jobbers of the country as well as the more radical ones. It is not dominated by any one man. Each of its members is perfectly competent and does speak for himself. It is a most capable organization with which the rest of the industry can work.

In the foregoing we do not wish to be misunderstood as criticizing the regular officers and staff of the Institute. From the inception of the institute when Bob Welch was chief executive to today, the regular staff has leaned over backward—too far backward we have thought at times—to keep out of the politics of the councilors' meetings wherein are elected the members of the board of directors. So far as the staff is concerned all the jobber has had to do is to pay down his $10 a year, make known his presence to the staff and ask for representation on the group of councilors from his district and also ask for his share of any members at large who are named by the board itself. But the jobber has not joined in any number and thereby he has missed a great opportunity. He could and should be the bulwark of the industry today in its fight and the fight of all industry against the unfair and illegal encroachments of government upon it.

But the failure of the jobber to join the Institute and attend its meetings does not excuse the majors for what they have done and have failed to do. Nor will it excuse the majors for failing now to establish such contacts with the jobber at once as will work toward a better understanding in the industry and the elimination of the no-profit activities in marketing.

East Texas Trucking More Difficult

TULSA, Nov. 16.—Federal and state forces in the East Texas field were reported this week to have made truck operations more unpleasant for some operators.

The federal tender board is reported to have ruled last week that all interstate tenders must be made out to the individual owners or operators. Since that time no truck tenders have been issued, but truck operators continued to move some products and federal charges were expected to be filed.

On Nov. 13 Ranger Purvis was reported to have been assigned to work under the direction of Capt. E. N. Stanley, and one of his first tasks was the serving of 27 warrants on truck operators.

A resume of the state's activities shows that from May 22 to Oct. 25 charges were filed against 204 truck operators. Of these 28 were fined, eight acquitted, 21 dismissed, 26 bonds forfeitured. There are 119 cases still pending.

Trial of 17 criminal cases filed in federal court for alleged violation of regulations regarding interstate trucking of oil and its products, has been postponed until the February term of court at Shreveport, according to word received here. Postponement was made by Federal Judge Cox who was sitting in the absence of the regular judge.

May Build Pipeline

TULSA, Nov. 19.—Continental Oil Co., has asked for prices on pipe for possible construction of a line from Oklahoma City to the recent strike in TWP 1-7 E, Pototoc county. If laid, the line would be about 85 miles long. The inquiry is for 8-inch pipe. Construction, it is understood, is conditional upon further successful drilling and the proving of the pool to be an important source of supply.

Halt Loading of Gasoline

LOS ANGELES, Nov. 18.—The loading with aviation gasoline of the tramp steamer Oregon was halted here Saturday by a strike of seamen who alleged that the cargo was destined for Italian Somaliland.

Policy Splits Committee Members In Michigan Investigation

By L. D. McGuan
N. P. N. Staff Writer

LANSING, Nov. 16

ATTEMPTING to reconstruct the difficulties of Michigan jobbers with securing franchises to market leaded gasolines, the Michigan legislative committee Nov. 14 and 15 questioned Charles J. Scanlon, Phillips Petroleum Co., and C. E. Smith, Ethyl Gasoline Corp., both of Detroit.

At the close of the hearing, Senator Leon Case, who presided in the absence of committee-chairman Senator Joseph A. Baldwin, announced that the hearings would be adjourned until Dec. 18.

The hearing was enlivened considerably Nov. 14 when during the questioning of Mr. Scanlon, Senator Earl W. Munshaw, republican, Grand Rapids, charged that the committee was pursuing a dilatory course and taking unnecessary testimony at the expense of the legislative appropriation which was nearly exhausted. The committee voted to continue along the same lines after considerable debate.

At the close of the Friday session John J. Cox, Michigamme Oil Co., Ann Arbor in a stirring appeal asked that no attempts to throttle the investigative efforts of the committee be tolerated.

Mr. Cox said it was his understanding that the funds of the committee were running low and the committee would have to adjourn without taking testimony of major company officials whom, he said, had repeatedly expressed their willingness to appear before the committee, but as yet have made no appearance.

The questioning of Mr. Scanlon related to the difficulty of the F. & S. Oil Co., Ethica, getting clearance of its Ethyl license, when it switched from Socony-Vacuum Oil Co., to the Phillips Petroleum Co., and his part in the stabilization efforts under the now defunct oil code.

Mr. Scanlon said that shipment of Phillips products to the F. & S. company had been delayed about a month, pending clearance of the Ethyl franchise. He testified "that he could see no reason for controversy" when he examined then existing contracts between the company and Socony-Vacuum.

When questioned closely on stabilization meetings held in Detroit under the old code, Mr. Scanlon's memory proved faulty on specific incidents.

C. E. SMITH, field representative for the Ethyl Gasoline Corp., took the stand Nov. 15. He said he knew nothing of the details of trouble experienced by F. & S. Oil Co., as it was not in his district. He was then asked to describe the routine followed when making an investigation where application for an Ethyl franchise has been made.

The refusal of the Ethyl corporation to grant a lead franchise to the Argo Oil Corp., Detroit, was then threshed out between Smith and Tappan.

Smith testified that application was made to handle leaded products of the Lincoln Oil & Refg. Co. He then made his investigation and he admitted that in his report he had recommended that no license be granted. He emphatically denied that his action was influenced by outside sources. He said he based his recommendation on the "physical aspect" of the company. On further questioning, Smith admitted that he had been making investigations and reports in the Detroit area for only about "two weeks" when he made his recommendation that no license be granted. He also admitted that he had made no personal check of the assets or equipment at that time, other than contacting and receiving from an official of Argo, the details of the marketing set-up.

He admitted that Argo has since been selling leaded gasoline through its pumps. He explained that when a jobber receives leaded gasoline from a supplier in the suppliers own tank truck, the jobber then assumes the status of a dealer, regardless of whether or not he is allowed jobber margins. It was explained that dealers selling leaded gasoline are not licensed.

The case of the Michigamme Oil Co., being refused an Ethyl franchise also was aired before the committee Nov. 15.

The Michigamme and Argo cases are closely parallel, except that the former was marketing leaded gasoline supplied by another jobber, the Staebler Oil Co. at Ann Arbor. Smith testified that this is forbidden by one of the provisions in Staebler's license agreement with the Ethyl corporation. Outside of pointing out this provision of the agreement, Smith said no threat had been made to the Staebler company.

He testified that all reports and investigations are sent direct by him to the district office, and then to New York for approval. He said he never receives an advance indication of whether or not a particular license would be granted or denied.

Frank McSweeney, Shell Petroleum Corp., Detroit took the stand late Nov. 15. He was asked to bring before the committee at its next hearing cost records on the marketing of gasoline in the Detroit area. Tappan indicated that he would not hesitate to use a subpoena, unless they were brought willingly.

TULSA, Nov. 16.—Kiowa Indian agency oil and gas leases offered at auction at Anadarko, Okla., Nov. 13, brought approximately $35,000. Prices paid ranged down from $22.25 per acre.

Arnott Pleads for Support of Code At A. P. I. Marketing Session

By Jack N. Westsmith
N. P. N. Staff Writer

LOS ANGELES, Nov. 15

NO DETAILS of the proposed voluntary code of fair marketing practices were considered at the group session, Nov. 13, of the division of marketing at the annual meeting of the American Petroleum Institute. Although the program announced that the code would be presented and discussed, the meeting was entirely devoted to appeals for support, coupled with criticism of those who opposed it, and no serious attempt was made to explain and justify those features of the code that jobbers have considered unsatisfactory.

B. L. Majewski, of Deep Rock Oil Corp. and former member of the P. & C. Committee, denounced the methods of those opposing the code and could see no merit in any of the objections contained in the report of the National Oil Marketers Ass'n.

C. E. Arnott, chairman of the special A.P.I. committee promulgating the proposed voluntary code, presided at the meeting and appealed for united support by jobbers, dealers, and distributors. He defended the secrecy adopted by the committee in its preparatory work but gave his assurance that every man in the marketing branch of the industry, regardless of the position he occupied, would have an opportunity to express his views freely.

After summarizing the history of the discarded federal code, Mr. Arnott told of the progress made to date in getting all branches of the industry to agree on the present proposals. Refiners, he said, were definitely sympathetic but the position of the jobbers was more uncertain. He was sympathetic with the problem of the jobber, distributor and dealer said that he had already arranged to make a thorough canvass of the opinions of these men, probably within the next 30 days.

In a paper on the marketing of petroleum products, Howard T. Lewis, professor of marketing, Harvard University Graduate School of Business Administration, discussed the pressure of crude oil for a sales outlet, the demand for disintegration of integrated companies, the increase in number of dealer outlets, the classification of channels, dealer margins, and the future of the independent retailer.

DR. LEWIS contended that "to peg the price of crude at a point that guarantees a profit to the submarginal well, leaving the price of gasoline free to move to the low levels current in recent years, not only forces the refiner to take losses that should not rest on his shoulders, but places an impossible burden upon a large part of the industry." He pointed out, however, that the industry finds itself in the embarrassing position of criticizing owners of stripper wells for demanding the right to produce oil at a cost in excess of what is said to be a fair figure, and then turning around and operating integrated service stations at a cost apparently substantially above that of independent stations.

"With all due appreciation of the pressure of crude on the market," Dr. Lewis said, "I am amazed at what has happened during the last few years. Essentially, this period has been one of declining prices, accompanied by a substantial falling off in per station volume of sales; apparently, too margins have been narrowing steadily. These factors have resulted in substantial losses to most units of the industry.

"One would have expected that, under the circumstances, the industry would have taken advantage of the opportunity thus presented by narrowing margins and rising costs to make some effort to reduce the number of outlets, particularly in view of the fact that many in the industry have contended for years that the evil of cut-throat price cutting has been the essential cause of most of the marketing problems of the industry.

Dealing with the position of the independents in the marketing branch of the industry, Dr. Lewis said:

"The place of the independent dealer and jobber is too well established, and the two are too important to the refiner, whether integrated or otherwise, not to be given all possible consideration—especially where sales per station are low or dealers scattered. The problem of the independent retailer is not dissimilar to that of the independent grocer, who faces keen competition from the chain store . . . .

"So long as the independent fought the chain merely by complaining about it, trying to legislate it out of existence, and seeking by taxation and other means to hamper its operation, the chains continued to grow. There is in this a lesson for the independent marketer of gasoline and other oil products. I do not believe that it is going to do a particle of good in the long run to try to maintain a healthy condition merely by asking that the integrated companies disintegrate, or by seeking to penalize them by discriminatory legislation, or by attempting by legislation to prohibit certain types of companies from engaging in retailing.

"In the long run, such efforts are, in my opinion, bound to be futile and extremely costly to all concerned. The independent dealer and jobber are indispensible. They can provide certain types of service better than any integrated company can render them. They can serve territories which no integrated company can begin to touch," he said.

"Big business must sell its accomplishments to the public or remain at the mercy of the political demagogue," Don Francisco, vice-president of

Lord & Thomas, said in his address on "Advertising petroleum products." Departing from his prepared paper, Mr. Francisco charged the oil industry with being so busy doing a good job in improving its products, perfecting distribution and cutting costs that it had neglected the equally important job of telling the public of its achievements. "Unless you tell people what you are doing for them," he said, "you are at the mercy of politicians, who seize upon the errors and weaknesses of the few to crucify you all before an uninformed public opinion.

"People may know the products you make. What they do not know is who you are, what you have done to effect economies in manufacturing and distribution, to improve your service, to save them time and money, to improve your products, to fill an economic need. They simply know that you are successful.

"And because they do not know of the place modern business occupies in our economic life and the service it renders the public, the popular notion of the day is to eliminate the efficient, sock the successful and tax the thrifty.

"Recently, here in California, our legislature passed and our governor signed a bill that will tax all chains having 10 or more outlets, $500 per store. Fortunately, service stations were exempted, for the present, but there is ample evidence that the proponents of the measure plan to eliminate the exemptions later if the courts do not throw them out as unconstitutional.

"This sort of thing is going on throughout the country. It is a tax on efficiency. But the chains and industry are to blame because they have not told their story to the public. For public opinion is usually fair—when it knows both sides of a question.

"The public thinks of you in terms of gross volume and net profits. If they knew that business is not big really to be big, but because that has been proven to be the best way to satisfy public demand for better service, better distribution for new and improved products, for lower prices—then the resentment against so-called 'big business' would not be so easily aroused.

"Of what good are the most efficient production methods, the most effective plans of distribution, the brainiest selling methods, and the most scientific advertising, if a mounting load of taxation penalyzes every success?"

Mr. Francisco suggested that the oil industry, individually and as a group, should sell itself to the American public by telling them—aggressively and without apology or defense—what successful, big business does for them. That, he believed, was the biggest sales problem of the industry.

Trends in automotive servicing were discussed by D. G. Coombs and L. B. Veeded of Shell Petroleum Corp. in the session of the marketing division on Nov. 14. This paper is reproduced in full beginning on Page 77 of this issue.

Resale Price Control Act Invalidated By Opinion of New York Court

NEW YORK, Nov. 19

POSSIBILITY of using the New York trade practice act as a means of preventing retail price cutting of branded products has received a setback as a result of a ruling by Supreme Justice Frederick P. Close, White Plains, that the act is unconstitutional.

The ruling was delivered late November 18, in a decision on a suit brought by Doubleday, Doran & Co., book manufacturers, against R. H. Macy & Co., large New York department store. The charge was that Macy's sold the books below the retail price established in a contract between Doubleday, Doran Co., the publishers and Doubleday-Doran bookshops, its retail outlet. The Macy Co. was not a party to the contract.

THE suit was the first in which the constitutionality of the law was involved. Supreme Court Justice Philip Brennan, in a Kings county, New York, court recently upheld the act, but a number of other issues were involved in the case.

The decision hinged particularly on that part of the fair trade act which states, in part, "that any one wilfully and knowingly selling any such commodity at less than the price stipulated in such a contract must respond in damages to any party injured, though the party so selling at the lower price is not a party to any contract."

In his opinion Justice Close stated "unless the courts are prepared to hold that by placing his brand upon a commodity the producer retains a property right in that commodity until it reaches the hands of the consumer, so that he may fix its price at every stage of distribution, this statute must fall."

Justice Close stated that in his opinion our fundamental law must be changed before such an act like the fair trade one could be upheld. He also held that the use of "loss leaders" was to attract customers and was no more destructive of competitors than other forms of advertising. The same results would be obtained, Justice Close said, if the defendant sold at the same price as the retailer-plaintiff, but gave a prize or premium with each article sold.

New York oil companies have been keeping a watchful eye on the fair trade act, with the possibility of applying it to their own retail problems in the event it is held constitutional by the higher courts. The opinion has been expressed by some attorneys that the act is valid as it applies to direct contracts between the producer and the retailer, but is unconstitutional as it applies to sales by a third party who has no contract with the producer.

A. P. I. Asks Treasury to Use Domestic Asphalt on Public Works Projects

By Lawrence E. Smith
N. P. N. Staff Writer

LOS ANGELES, Nov. 16

IT IS difficult to remember that a more serene annual convention of the American Petroleum Institute has ever been held than the one which closed yesterday. There was complete absence of controversial questions to divide sentiment and induce temporary hard feeling. There was agreement on all propositions which were presented to the board of directors. Few questions were presented at all.

No sentiment for federal control was present; at least, none was expressed. On the contrary, the idea was given vigorous trouncing from the platform in the general sessions. President Axtell J. Byles led off with a condemnation of bureaucratic direction of industry. Vigorously seconding the motion were Col. Ernest O. Thompson, chairman of the Texas Railroad Commission and Gov. E. W. Marland, Oklahoma. Col. Thompson was there. The Okahoma governor's address was read by Tom Anglin, his official alternate on interstate compact business.

The addresses of these three were reported in detail in the Nov. 13 issue of NATIONAL PETROLEUM NEWS.

The compact plan, given a preliminary shove into the stream by A. P. I. directors last year, was cheered on its way in the report of the executive committee of the Institute this year.

In furtherance of the plan, whose adherents now number six, a meeting was held Nov. 14 with Gov. Merriam, California. This state has not joined and it was to lay the foundation for its joining that the meeting was held. Compacters Tom Anglin, Art L. Walker, the secretary; Col. Thompson and Hiram Dow, New Mexico, met with the governor, found his attitude favorable, as it always has been since Gov. Marland last December took the intitiative by calling a meeting in Oklahoma. But the California legislature has to give approval, so nothing can be done for some months.

In one resolution the directors called attention to violation of the Domestic Origin Act of Congress by the procurement division of the Treasury Department. By order of the secretary, this division on Aug. 27 gave authority for the purchase of asphalt made from foreign oil for use in public works.

Institute directors asserted that this was a discrimination against the oil industry of the U. S., that there are abundant supplies of domestic asphalt at reasonable prices, said the Domestic Origin Act was to foster employment and that purchase of foreign asphalt hinders realization of that purpose, called upon the President and the Secretary of the Treasury to amend the order of the procurement division.

Next convention will be held in Chicago, Nov. 9, 10, 11 and 12. Directors agreed to the recommendation of the board of councillors. It was the first time the councillors had asserted their preference as to meeting place. The annual mid-year meeting will be held in May in Tulsa. Dates will be set later by the executive committee.

This year's convention was splendidly attended, more than 3000 registrants being reported. California turned out its best brand of weather and put its best foot foremost to help the visitors have a good time. This was one meeting that appealed to the wives of oil men and the feminine attendance was greater than in any recent year. The entertainment committee had done its work faithfully and well and no one could complain of ennui.

Axtell J. Byles was re-elected president; William R. Boyd, executive vice-president; Lacey Walker, secretary and assistant treasurer and J. S. Cooke, assistant secretary. These constitute the elective personnel who conduct institute affairs. Other officers elected were George A. Hill, Jr., Houston Oil Co., vice-president for production; Jacob France, Mid-Continent Petroleum Corp., vice-president for refining; C. E. Arnott, Socony Vacuum Corp., vice-president for marketing. Messrs. Hill and Arnott were re-elected, Mr. France succeeded William G. Skelly, Skelly Oil Co.

O. D. Donnell, Ohio Oil Co., was elected treasurer, succeeding Dan Moran, Continental Oil Co.

All members of the American Petroleum Industries Committee, which has charge of the campaign on taxation, were re-elected.

The three divisions of the institute elected twenty members each to serve as the committee in charge of activities for the coming year. These selections, together with the five for each group named by the Institute board, were as follows:

Production Committee

Appointed by president: O. D. Donnell, Ohio Oil Co.; John M. Lovejoy, Seaboard Oil Co., of Calif.; Ralph B. Loyd, Oil Producers Sales Agency of L. A.; J. Edgar Pew, Sun Oil Co..; E. L. Smith, E. L. Smith Oil Co.

Elected by division: A. M. Blow, Amerada Petroleum Corp.; P. H. Bohart, Gypsy Oil Co.; Chas. Bunje, Jr., Illinois Pipe Line Co.; R. E. Collom, Continental Oil Co.; C. P. Dimit, Phillips Petroleum Co.; F. F. Hill, Union Oil Co. of Calif.; R. B. Kelly, Pure Oil Co.; Clark H. Kountz, Sinclair Prairie Pipe Line Co.; C. H. Lieb, Carter Oil Co.; M. E. Lombari, Standard Oil Co.; W. L. McLaine, General Petroleum Corp.; T. V. Moore, Humble Oil Co.; W. M. O'Connor, Atlantic Refining Co.; R. Ogarrio, The Texas Co.; R. B. Pringle, Tidewater Oil Co.; F. O. Prior, Stanolind Oil & Gas Co.; J. H. Russell, Gulf Production Co.; D. R. Snow, Barnsdall Oil Co.; H. R. Straight, Empire Companies; T. E. Swigart, Shell Petroleum Corp.

Marketing Committee

Appointed by the President: W. H. Ferguson, Continental Oil Co.; W. V. Hartman, Gulf Refining Co.; E. T. Moore, Simms Oil Co.; E. B. Reeser, Barnsdall Oil Co.; Chas L. Suhr, Pennzoil Co.

Elected by Division: W. T. Atkins,

Skelly Oil Co.; W. C. Burns, Richfield Oil Co. of New York; J. W. Carnes, Sinclair Refining Co.; J. D. Collins, Tide Water Oil Co.; R. K. Davies, Standard Oil Co. of Calif.; H. W. Dodge, The Texas Co.; S. B. Eckert, Sun Oil Co.; Frederick Ewing, Socony Vacuum Oil Co.; H. D. Frueauff, Cities Service Co.; R. R. Griffin, Shell Union Oil Corp., New York; C. N. Humphrey, Standard Oil Co. of Neb.; Allan Jackson, Standard Oil Co. of Ind.; V. H. Kelly, Union Oil Co. of Calif.; R. W. McDowell, Mid-Continent Petroleum Corp.; George C. Morris, Pure Oil Co., Chicago; C. G. Sheffield, Standard Oil Co. of N. Y., New York; C. S. Smith, National Refining Co., Cleveland; H. A. Trower, Phillips Petroleum Co.; W. G. Violette, Standard Oil Co. of Ky., Louisville; W. C. Yeager, Atlantic Refining Co.

Refining Committee

Appointed by president: Clyde M. Boggs, Kanotex Refining Company, Arkansas City, Kan.; W. M. Irish, Atlantic Refining Company, Philadelphia, Pa.; H. A. Logan, United Refining Company, Warren, Pa.; P. M. Miskell, Empire Oil & Refining Company, Tulsa; J. Howard Pew, Sun Oil Company, Philadelphia, Pa.

Elected by Divisions: L. S. Bale, Standard Oil Co. of Ohio, Cleveland; C. R. Barton, Tide Water Oil Co., New York; C. B. Buerger, Gulf Refining Co., Pittsburgh, Pa.; W. P. Burt, Socony-Vacuum Oil Co., New York; Fayette B. Dow, National Petroleum Association, Washington; C. L. Henderson, Vickers Petroleum Co., Wichita, Kan.; F. E. Holsten, Barnsdall Oil Co., Tulsa; Emby Kaye, Skelly Oil Co., Tulsa; F. B. Koontz, Mid-Continent Petroleum Corp., Tulsa; W. F. Lowe, Natural Gasoline Association of America, Tulsa; F. T. Manley, The Texas Co., New York; Walter Miller, Continental Oil Co., Ponca City, Okla.; G. G. Oberfell, Phillips Petroleum Co., Bartlesville, Okla.; M. C. Paulus, Standard Oil Co. of Indiana, Chicago; C. F. Smith, Standard Oil Co. of New Jersey, New York; W. L. Stewart, Jr., Union Oil Co. of California, Los Angeles; G. H. Taber, Jr., Sinclair Refining Co. New York; C. B. Watson, Pure Oil Co., Chicago; G. H. Van Benden, Shell Oil Co., San Francisco.

The following individuals were re-elected by the Board of Directors to the At-Large Group, elected by that body: C. E. Arnott, Socony-Vacuum Oil Co., Inc., New York; J. Frank Drake, Gulf Oil Corp., Pittsburgh; W. S. Fitzpatrick, Consolidated Oil Corp., New York; W. M. Irish, Atlantic Refining Company, Philadelphia; E. T. Moore, Simms Petroleum Company, Dallas; Thos. A. O'Donnell, Los Angeles, California; W. S. S. Rodgers, The Texas Company, New York; E. L. Smith, E. L. Smith Oil Company, Mexia, Texas; Paul G. Blazer, Ashland Refining Co., Ashland, Kentucky; B. L. Majewski, Deep Rock Oil Corp., Chicago; A. Jacobsen,' American Petroleum Corp., New York; and T. P. Thompson, Jr., Pennsylvania Grade Crude Oil Association, Bradford, Pa.

The election of other directors was reported last week.

Wildcatting Program Seeks Paleozoic Oil in Belgium and Westfalia

AN INTERESTING development in European exploration at present is the search for oil and gas in the upper-Carboniferous foreland zone, bordering the front of the Permo-Carboniferous (Variscide) chains in Belgium and Westfalia, according to a letter to NATIONAL PETROLEUM NEWS from Dr. W. A. J. M. van Waterschoot van der Gracht.

Dr. van der Gracht, who is well known in this country through his connection with the Marland interests a number of years ago, writes that the search has been stimulated by the similarity of source and reservoir sediments and general geologic and structural conditions with the Appalachian oil and gas belt in Pennsylvania and West Virginia, which extends along the outer front of the very similar Appalachian Mountains, of about the same age as the old European Mountains south of the coal fields of Westfalia and Belgium. A more or less similar condition repeats itself in Oklahoma and Texas.

Evidently a search of this nature can only be made at a certain distance from the strongly folded and overthrust mountain front, where regional metamorphism has not unfavorably affected eventual oil deposits. In the zone worked by coal fields the sequence is still devoid of oil and is only moderately gas bearing, whilst most of these gases apparently originate from the coal seams.

Contrary to conditions prevailing in North America, exploration on the European continent is handicapped by the great thickness of Mesozoic, and locally also Tertiary sediments which overlie the Carboniferous, a thickness which soon reaches 4000 to 5000 feet, making deep drilling imperative and structural subsurface work difficult.

At present two important test wells are drilling, the one near Ascheberg, south of Munster in Westfalia, on a subsurface anticline, characterized by a concentration of strong showings (even blowouts) of wet petroleum gas, including a 30 years old well which, although in very poor condition, still yields gas at 400 lbs. pressure. The other well is near the village of Moll, in the Belgian Campine.

Both test wells are a considerable distance north of the zone worked by coal mines. They are of the most modern type, equipped with machinery which will enable the operators to reach the greatest depths modern technique permits, if such should be required.

Both wells have now reached a depth of around 3000 feet.

Supreme Court to Review Chain Store Tax Case

WASHINGTON, Nov. 19. — The Supreme court "noted probable jurisdiction" Nov. 18 in *Ashland Refining Co. vs. Fox* involving application of the West Virginia chain-store tax law to stations operated under Lease and Agency agreements and stores and other establishments where the company has installed pumps under Lease and Agency agreements.

On Oct. 14, the court consented to hear Gulf Refining Co.'s similar appeal regarding application of the tax to its authorized dealer stations.

Last January the court held that filling stations were "stores" under the tax law but did not rule directly on the status of leased stations or exclusive dealers.

Treasury Issues New Regulations Covering Federal Oil Taxes

By A. M. Petty
N. P. N. Washington Bureau

WASHINGTON, Nov. 18

REGULATIONS covering changes in administrative provisions of the federal taxes on gasoline and lubricating oils were promulgated Nov. 12 by the Internal Revenue Bureau in Treasury Decision No. 4604.

These changes were embodied in the amendment, sponsored by Senator Gore, of Oklahoma, which was tacked on the "tax-the-rich" law enacted by Congress last session. The changes in the law became effective October 1.

No change is made in the tax rate of 1 cent a gallon on gasoline and 4 cents a gallon on lubricating oils. The Gore Amendment and regulations are intended to simplify administration of the law.

A special subcommittee of the American Petroleum Industries Committee, headed by Willis Crane, associate counsel of the National Petroleum Association, worked with the Internal Revenue Bureau in preparation of the regulations.

Principal changes in the tax law and regulations were, as follows:

All "sales for the exclusive use of the United States, any State, Territory of the U. S., or any political subdivision of the foregoing, or the District of Columbia," are entitled to tax-exemption.

The "ultimate vendor" (no matter how far removed from the manufacturer) is entitled to a tax refund or credit which he may obtain, in co-operation with his manufacturer, on proof that the sale was for a tax-free purpose.

Interest at six per cent per year is provided on tax refunds. Interest charges on delinquent tax assessments have been reduced from 12 to six per cent.

While the "ultimate vendor" may make a sale entitled to tax-exemption, under the new law and regulations, all the negotiations with the Internal Revenue Bureau regarding the sale are conducted by the manufacturer (that is, the refiner, compounder, blender, etc.). The manufacturer pays the tax and is responsible for it, according to the regulations.

In promulgating the new regulations, the Internal Revenue Bureau offered five model exemption certificate forms. However, it is not necessary to follow these forms exactly.

No changes were made with respect to sales of gasoline and lube oils from one manufacturer to another. Of course, the appropriate exemption certificate must be secured.

THE new law and regulations apparently do not affect existing practices in sales for export and to possessions of the U. S. Apparently, it is still necessary to prove in advance that the sale is for export in order that it may be made tax-free.

No change is made in existing regulations covering tax-exempt sales of unfinished material for further manufacture.

Formerly, sales of gasoline and lube oil to the U. S., the District of Columbia, or a Territory or possession of the U. S. (except exports and supplies for ships) were not tax-free.

Sales to the States and their political subdivisions were tax-free, but only when the gasoline or oil was for an "essential governmental function." The Bureau placed on the oil company the burden of proving that the sale was entitled to exemption from tax. Many hairline distinctions were drawn by the Bureau in its rulings. Some states, like New York, contended that all their functions were "essential governmental functions." Oil companies seeking such business, in some instances, were forced to deduct the tax and take a chance on convincing the Bureau that the state was right in its contention.

Under the new regulations it is no longer necessary to delve minutely into the governmental agency operations to determine whether it is a "proprietary" or "essential governmental function." All that is required is to show that the gasoline or oil was purchased for the "exclusive" use of the governmental agency (or for some other tax-free purpose).

The test will be "exclusive use"; whether the Bureau will make hairline distinctions on this point, remains to be seen. Probably, the Bureau will be satisfied with a properly executed exemption certificate, which is executed and accepted in good faith.

One of the first rulings on this point was issued Nov. 13 by the Bureau, holding that sales of gasoline and oil to Post Exchanges for resale to Army personnel are subject to the federal tax. (However, such sales are still exempt from state and local taxes).

The new regulations provide that on and after Oct. 1, 1935, no tax attaches to the sale of gasoline or oil for the "exclusive use" of the U. S. or other governmental agencies, if the sale is made directly by the manufacturer.

On and after Oct. 1, the manufacturer apparently cannot make a tax-free sale to any dealer or other reseller even if it is known at the time of sale that the resale will be for an exclusive governmental use. (In regulations covering other classes of sales entitled to tax-exemption the effective date is Nov. 12, 1935 which is the effective date of the regulations. The reason for the difference in dates is not entirely clear).

The tax must be paid on every sale to dealers or other resellers (except in the case of sales for further manufacture or export). However, the dealer or reseller, no matter how far down the line he is, is entitled to a tax refund or credit when he resells tax-paid gasoline or oil for an exclusive governmental use (or for other tax-exempt purpose). And this is so, even though the

(Continued on page 87)

Costs of Polymerization of Refinery And Natural Gases Studied

By Arch L. Foster
N. P. N. Staff Writer

LOS ANGELES, Nov. 14

POLYMERIZATION of refinery and natural gases, the relative merits of catalytic and thermal processes, and the merits and demerits of mineral oils vs. the same oils treated with addition agents which presumably add greater "oiliness" and lubricating value, were the topics of absorbing interest to the refining technical division of the American Petroleum Institute meetings, which closed here today.

Refinery and natural gases may be cracked and polymerized at pressures of 800 to 1200 pounds per square inch, and temperatures of 1000 to 1030 F., according to data presented by P. S. Keith, and J. T. Ward, of M. W. Kellogg Co. The Keith-Ward discussion, the first formal presentation of the process principles represented by the Indiana-Texas-New Jersey - Phillips - Kellogg combine organized last September, to develop thermal polymerization was especially provocative of discussion, to bring out the numerous points of the process and its product which are of consuming interest to refiners.

Refiners in general are seriously studying the relative merits and advantages of these three processes — Pure, Universal, and Phillips—and, in spite of the immense amount of data and information available in the published literature and in the papers and discussion prevented, have not always been able to find the answer which is satisfactory to them. This is inevitable in a development so new, commercially, and which has been advancing so rapidly during the last year as has polymerization.

Obviously, the dominant questions in the minds of refiners and prospective licensees of polymerization processes are: How much gasoline can I produce from my gases? What octane number do I obtain? What is the overall cost per gallon? Cooke, Swanson, and Wagner mention a cost of less than 5 cents per gallon, which includes the total cost of all items which may properly be charged against the operation. Keith and Ward find that 3.53 cents per gallon represents the "operating" cost, but the majority of the listeners appeared to be uncertain as to whether or not this figure included all amortization and other "overhead" charges.

GUSTAV EGLOFF, in discussing the papers presented, stated that he is certain that the cost of polymerization of unsaturated still gases is less than the values mentioned in these papers. Summarizing the operating conditions given in the two papers presented here, Egloff pointed out that The Kellogg process uses temperatures of 950-1100 F. at 800-1200 pounds pressure, while the Pure Oil Co. may use either 900-1000 F. at 600-800 pounds, or 1150-1300 F. at 50-75 pounds pressure, depending on the results desired. The impression of refiners, naturally, is that, other things equal, the lower pressures are preferable from a cost point of view, both from the standpoint of compression costs, and the over-all purchase, maintenance and amortization costs of the plant. This may or may not be counteracted by difference in yields or qualities of product.

In the mass of data presented and discussed verbally, the following points stand out in the minds of interested observers. Both the catalytic and the Kellogg thermal processes, (and the Pure, as far as operating conditions when used identical with the Kellogg process are concerned), give rather comparable yields per 1000 cubic feet, and also as to octane ratings obtained. The variation in operating and other conditions is so wide, that exact comparisons cannot now be made, without restricting these conditions carefully. The catalytic process shows indications of lower overall costs, particularly for the reasons of less severe operating conditions pointed out above. The thermal processes apparently offer a wider field of application, because of the fact that saturated as well as unsaturated gases may be treated and polymerized.

However, there appears to be no reason why either pyrolytic, or catalytic, dehydrogenation, followed by either type of polymerization may not prove equally successful. In discussing the combination of pyrolysis-polymerization of saturated gases, Egloff pointed out before the meeting, (See paper presented before American Chemical Society, San Francisco, August, 1935), that it is technically wrong to attempt to carry out two opposing reactions in the same vessel, to have these two reactions going on at the same time. Cracking is endothermic; polymerization is exothermic, as Wagner proved so conclusively in his experiments and reported in his paper before the American Chemical Society, April, 1935. Therefore, from a theoretical standpoint, cracking and polymerization of gases should be carried out separately, for optimum results, according this opinion.

Keith pointed out in discussion that reactions take place note only between olefins but between olefins and paraffins, in other words, alkylation does take place. This reaction has been questioned, and the consensus was that it has not been proved conclusively, although it is quite possible. Keith stated also that the motor fuel produced by their process requires the use of an inhibitor (as does any polymerized gasoline, it seems), and observed that one inhibitor gives an induction period of 240 hours with the polymerized product.

Egloff indicated that a 90 per cent yield of propylenes and butylenes is obtained from the

corresponding paraffins, using catalytic dehydrogenating methods. Catalysts may be used, it was indicated, to inhibit the formation of methane, or gases may be dehydrogenated catalytically to produce ½ per cent or so of methane. This product may then be polymerized catalytically to motor fuels, which are essentially olefins. To produce iso-octane, hydrogenation may be employed.

It was also stated that 5 to 8 per cent of tars, etc. are formed in thermal polymerization. So far as is known no appreciable amount of tar is produced by catalytic methods. Without a complete material and product balance in the data already at hand, it is not clear what effect these and many other variations have on the final yield of marketable motor fuel.

Wagner, in discussion, explained for the information of the meeting that the lower gravity products reported in his paper contained approximately 95 per cent or more of aromatics. This is more than satisfactory to meet the requirements for nitration operations, to yield a large list of products normally obtained only from coal tar, he stated. The higher gravity material made by the Pure process contains 25-30 per cent of olefins, and the remainder is naphthenes, he stated. An exhibit of various products so produced will be held at the Chemical Exposition in New York, the first part of December, it was announced.

To the impartial observer, intent on obtaining the greatest amount of practical information to enable him to decide the relative practicability of the various processes now before, and available to, the licensee, the problem is a formidable one. The honest attempt to evaluate advantages and disadvantages so as to arrive at a reasonable conclusion as to relative merits, costs, and quality of product appears to offer success only after an exhaustive weighing of these various items, in the light of far more data than can be presented conveniently in the limits of a paper before a technical organization. Trends may be indicated; results under a given set of conditions may be shown with reasonable exactness; qualities of products, in terms of recognized tests and measuring methods, may be compared with considerable assurance that conclusions so arrived at are essentially fair and correct.

However, the industry is only entering the realm of polymerization and the possibilities which it holds for more efficient utilization of petroleum products. A stupendous amount of work yet remains to be done before these processes, or even the principles of gas pyrolysis and polymerization can be properly understood or utilized.

It is probable that the characteristic of oiliness in lubricants, as differentiated from film strength, is the result of the formation of a true adsorbed film (of lubricant) of substantial thickness and permanence, by polar molecules (on the bearing surface), according to the opinions of L. L. Davis, B. H. Lincoln, and B. E. Sibley, Continental Oil Co., in discussing the problem of practical selection of improved lubricants. In pointing out the misconceptions and misconstructions which may be placed on so-called "test" results, either from ignorance or by taking advantage of ignorance, these authors observe that, as an instance, the Almen machine, originally designed to show the relative efficiency of extreme pressure lubricants, and because of its portability, has been used widely, (as has also the Timken machine and variations of it), to show the purported superiority of "film strength" as a measure of the improved lubricating qualities of a given oil in service.

They stress the fact that these machines use steel-on-steel contacts, to show the "value" of oils containing addition products to increase film strength. Such machines, they say, show frequently very high ratings on materials which are very corrosive, and totally undesirable in a crankcase. The only permissible use of such machines, they indicate, is to determine long-time wear characteristics using various oils, using steel-on-bronze, comparable to engine operating conditions.

In tabulated results of tests with various additions agents on bearings in this type of test, it was shown that a high film strength may likely indicate very corrosive products. In corrosion tests shown, chlorine compounds showed, with some exceptions, to be highly corrosive to various types of bearings, including copper-lead, silver-cadmium and others. Most of these showed relatively high film strengths on Timken or Almen tests, but corrosion effects were entirely too severe to permit their use in bearings. The authors showed, however, that by methylating a chlorostearic acid or stearate, this corrosiveness is eliminated, while at the same time retaining the oiliness which they believe adds to the efficiency of the compounded lubricant.

Some remarkably interesting results have been shown, both during the discussion of these two papers, by those convinced as well as unconvinced of the need for or desirability of addition compounds. T. G. Delbridge discussed at some length

Oppose Octane Increase

That the tremendous majority of cars now on the road require no better than 65 octane number for satisfactory performance, was the statement of A. Ludlow Clayden, in making the report of the automotive survey committee. The average car is now nearly five years old. The refining industry is making motor fuels to meet the requirements of the newest engines, whereas the huge majority of cars do not require this additional five octane numbers.

These facts become doubly significant, in the light of strong rumors now afloat that efforts are being made to boost the octane "standards" of motor fuels. If such changes are now made, after a comparatively satisfactory moratorium in the octane race during the last two years, the additional cost to refiners to produce and distribute fuels to supply this relatively small number of high compression ratio cars promises to wipe out any small advantage obtained by the increase in refinery gasoline prices made effective during 1935, in the opinion of refiners, most of whom are in strong opposition to any increase in octane rating now.

the use of phosphoric acid derivatives which Atlantic Refining Co. has been using, and which he stated eliminates more completely the chance of corrosion detracting from the value of the lubricant. However, in much of the discussion, the variation between wear and corrosion shown by compounded and uncompounded lubricants was, in the opinion of many observers, so slight and so likely to be reversed in order by other variables, that the results may not be considered as wholly conclusive, on these points.

The theory has been advanced that "wear" is due chiefly to corrosion produced by combustion products generated during the warming-up period when the cylinder walls are below, say, 194 F. temperature. These authors advanced the idea that probably the adsorbed film from an addition product forms a protective coating over the wall, to reduce this corrosion "wear" which is believed to be the major cause of wear.

Some further interesting information has come to the attention of the writer, which information was not brought out in the discussion of these papers. Testing a pure mineral oil and a similar one to which an oiliness compound had been added, showed that as the test went on, the amount of the addition product present decreased rapidly to reach in a short time a certain low value, which did not vary during a long and severe test, once that value was reached.

The "natural acidity" produced in the pure oil by oxidation during the test, reached an equilibrium value at almost identically the same point in the test, and similarly did not vary appreciably. The two values at equilibrium were approximately the same value, and the results of the two tests were practically identical, so far as could be determined. Such results have been interpreted to mean that the natural oxidation of the pure mineral oil, in service, produces "oiliness" compounds, which serve the same purpose as the addition products.

The oiliness problem is still short of a satisfactory answer, in the opinion of the majority of technologists, who cannot find absolutely conclusive evidence to unequivocally reject or accept the idea, under present conditions.

G. G. Brown showed, in an exhaustive but not preprinted paper on the effects of increasing volatility of motor fuels on the performance of an engine, that lowering the manifold temperature by ten degrees F. is equivalent in maximum power output to increasing octane rating by about one number. Similarly, reduction of the manifold temperature 100 F. equals approximately the boosting of octane number of the fuel from 70 to about 80. He showed also that these results agreed substantially with those reported by Neill MacCoull, in the Journal of the Society of Automotive Engineers in 1933.

Amendment to Clayton Act is Proposed

WASHINGTON, Nov. 19.— Amendments to plug up "loopholes" in the Clayton anti-trust law, which have made it "almost impossible" to apply the law to chain-store systems, are being drafted by Senator Frederick Van Nuys, of Indiana, for introduction when Congress meets in January.

What Senator Van Nuys proposes is, in effect, to enact a stringent national "anti-discrimination" law, such as is now on the statute books of some states. He proposes to knock out the provisions in Section 2, of the Clayton act which, he contends, "legalizes discrimination in price on account of difference in grade, quality or quantity or where such discrimination makes only due allowance for difference in cost of selling or transportation or is made in good faith to meet competition."

Striking out this provision, according to Van Nuys, will leave Section 2 "in plain, understandable terms, a declaration that discrimination in price between different purchasers is unlawful, where the effect of such discrimination may be to substantially lessen competition or tend to create a monopoly."

Other amendments contemplated relate to acquisition of stock or assets of competing corporations.

Senator Van Nuys indicated that his proposed legislation was primarily aimed at the retail grocery, drug and other chain stores.

Daily Average Production, Important Districts, American Petroleum Institute Figures

	Week Ended Nov. 16 Barrels	Nov. 9 Barrels
Okla. City	156,700	144,200
Total Okla.	514,250	490,600
East Texas	431,900	430,650
Total Texas	1,056,100	1,037,150
California	679,100	683,500
East of Rockies	2,171,500	2,118,750
Total U. S.	2,850,600	2,082,250
Crude Imports	10,420	91,430
Total New Supply	2,861,020	2,893,680

Approved Michigan Pipeline

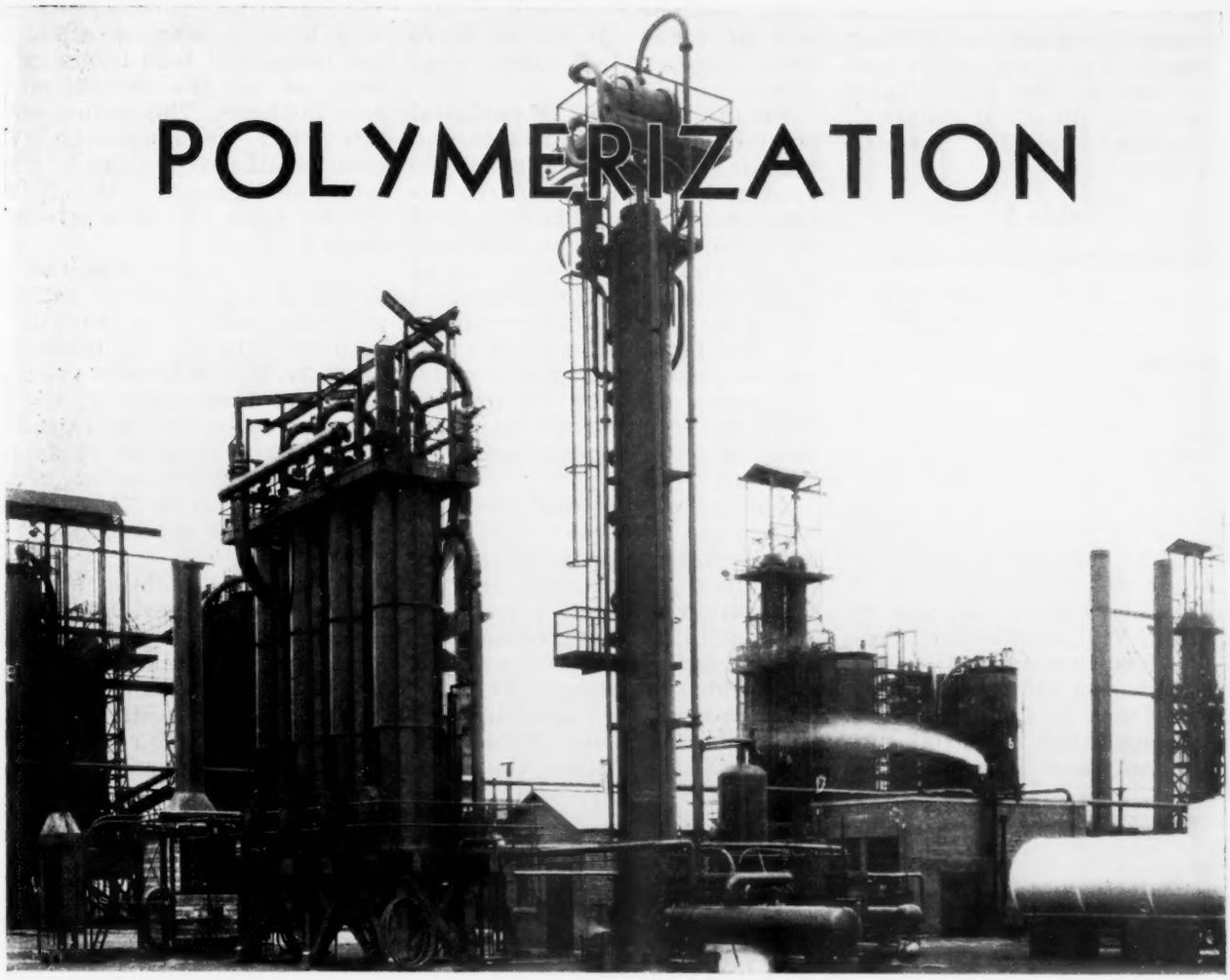
LANSING, Nov. 16. — The Michigan Public Utilities Commission approved, Nov. 14, the proposal to lay the first interstate pipeline to transport crude from Michigan fields.

The line will be about 140 miles long, between the Crystal field, and Toledo, Ohio, and will be constructed by the Michigan-Toledo Pipe Line Co.

U. S. Crude Stocks Drop 1,261,000 Barrels

WASHINGTON, Nov. 18.— With domestic oils resuming their downward trend, crude stocks in the United States dropped to 299,722,000 bbls. on Nov. 9, the Bureau of Mines reported today. This was a decrease of 1,261,000 bbls. from the previous week. Domestic oils, which increased during the previous week for the first time since June 1, decreased 1,372,000 bbls. Foreign oils were up 111,000 bbls. Crude stocks a year ago totaled 329,072,000 bbls.

Grade of Crude	Nov. 2 (Thousands of Barrels)	Nov. 9 (Thousands of Barrels)	Change (Thousands of Barrels)
Penna. grade	4,705	4,721	+ 16
Other Appal.	801	834	+ 33
Lima-N. E. Ind.-Mich.	1,512	1,402	— 110
Ill.-S. W. Ind.	11,137	11,159	+ 22
N. La. and Ark.	10,633	10,595	— 38
W. Tex.-S. E. N. Mex.	29,555	29,321	— 234
East Texas	23,544	21,828	—1,716
Other Mid-Cont.	133,323	132,882	— 441
Gulf Coast	25,137	25,814	+ 677
Rocky Mountain	26,840	26,796	— 44
California	30,899	31,362	+ 463
Domestic	298,086	296,714	—1,372
Foreign	2,897	3,008	+ 111
Total crude	300,983	299,722	—1,261



A Tool of Great Economic Utility

By Gustav Egloff*

THE increased demands of the motor industry for higher quality fuels during the past years have been supplied by the cracking process. Now gasoline with ever higher non-detonating properties has brought about the polymerization of cracked gases in addition to reforming of gasoline and heavy oil cracking. Motor fuel of high octane number has led to increased efficiency in the automotive and aircraft engines. The automobile top speed of 60 miles per hour in 1925 to over 100 in 1935 and the cruising speed of transport planes from 80 miles per hour to over 210 are striking advances brought about by the co-operative efforts of the automotive and oil industries. This progress was made possible by enhancing the antiknock property of gasoline. The appearance of commercial gasoline with 100 octane number is now a recognized achievement.

The cracking of gasoline and heavy oils has increased the yield of gases in 1934 to over 300 billion cubic feet, 50 billion of which are olefins that can be catalytically polymerized to over one billion gallons of 81 octane number gasoline. The deolefinized gas may be made to yield another two billion gallons of the same quality motor fuel by dehydrogenation and polymerization.

The *potential* volume of polymerized gasoline from cracked gases represents over 15 per cent of the total gasoline output of 1934. The average octane number for gasoline in 1934 was about 66. Therefore, the potential production of 15 per cent of the gasoline supply with octane number of 81 and a blending value of 103 to 125 by means of catalytic polymerization of cracked gas is one of the most important developments in the oil industry.

In 1934, the refinery gases from crude oil were a potential source of over 1,000,000,000 gallons of polymerized gasoline if the propane and butanes had been dehydrogenated and the olefins polymerized. The potential yield of polymer gasoline from the propane and butanes available in the natural gas and gasoline industries, alone, was five billion gallons. Therefore, the total polymerized gasoline potentially

*Universal Oil Products Co. Research Laboratories, Chicago.

available in the United States was over 9,000,000,000 gallons, or about 50 per cent of the gasoline used during 1934. Table 1 shows the potential supply of polymerized gasoline for the year 1935.

Table 1

Potential Polymer Gasoline

Source	Potential Polymer Gasoline Yield in Gallons
Refinery gases from crude oil	1,000,000,000
Cracked gases	3,000,000,000
Natural gas and gasoline industries	5,000,000,000
Total	9,000,000,000

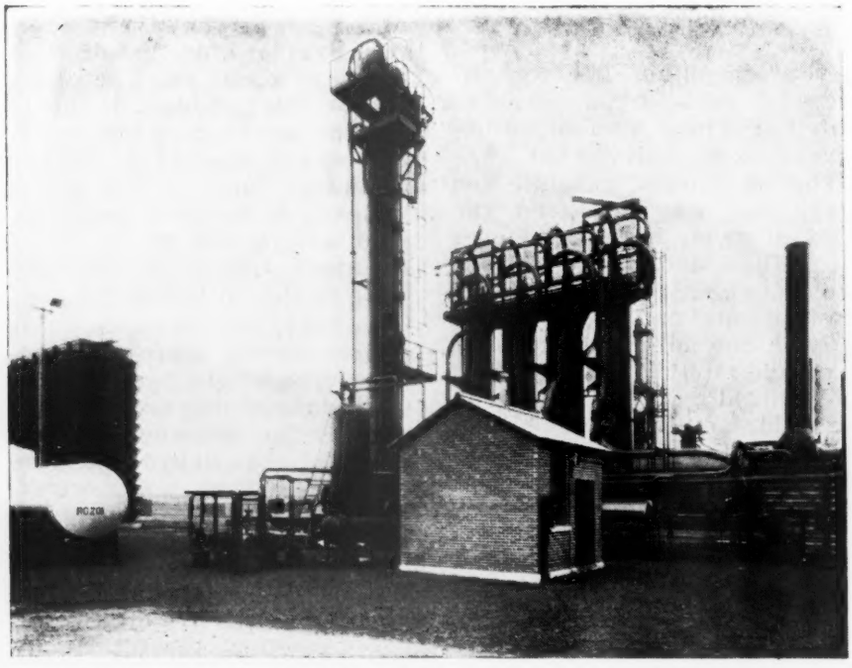
In 1934, 900,000,000 barrels of crude oil were processed to yield 17.8 billion gallons of gasoline. The amount of crude oil required to produce the 1934 demand for gasoline would have been reduced to 60 per cent of its volume if the potential supply of polymer gasoline had been used; or 360,000,000 barrels of crude oil would have been conserved in that year alone.

On the basis of the potential polymer gasoline available and blending with other gasolines produced by the refiner, the octane number would be increased from 66, the present average, to 78. Or, without the use of lead, the average octane rating would be increased from 59 to 74. This increase in octane rating of motor fuel would yield, in motors designed for its use, a 10 to 12 per cent improvement in power output and fuel economy.

The use of the catalytic polymerization process will have far-reaching effects upon the oil industry for it will provide a premium product, a blending agent with a higher value than either benzol or isooctane, and will reduce the amount of crude oil required to operate our automotive engines. From the economic viewpoint, the production of polymerized gasoline will have a marked effect on the tetraethyl lead industry, as well as on the benzol motor fuel industry. The reduction in tetraethyl requirement when even small percentages of polymer gasoline are used is apparent from the data given in table 2.

Table 2

	cc./gal. T. E. L. to equal 70 Octane No. with various percentage of Polymer Gasoline		
	0%	4%	6%
(1) 57 Octane Base Fuel	1.40	.....	.....
with High Sulfur Polymer	.....	1.35	1.25
with Low Sulfur Polymer	.....	1.30	1.20
(2) 60 Octane Base Fuel	0.90	.....	.....
with High Sulfur Polymer	.....	0.85	.....
with Low Sulfur Polymer	.....	0.75	.....



Catalytic polymerization unit installed at refinery of Shell Petroleum Corp.

It will be noted that the addition of 4 per cent of polymer gasoline affects a saving of 0.10 to 0.15 cc. of tetraethyl lead. Or, if it is desired to eliminate the lead entirely, the 57 octane fuel could be raised to 70 with the addition of 24 per cent of polymer gasoline, or the 60 octane fuel to 70 with the addition of 21 per cent polymer gasoline.

To the automobile industry increased compression ratio motors will mean better performance and increased maximum speeds, without added fuel consumption, and in the airplane industry higher transport speeds, lighter engines, less fuel load, higher pay load, lower maintenance costs follow the use of polymerized gasoline and to both industries the catalytic polymerization process offers a gasoline of constant and controlled composition.

Since polymerization is the combination of olefins to form larger molecules it is apparent that saturated substances (paraffins) do not yield polymers. On the other hand, saturated hydrocarbons may be catalytically dehydrogenated or cracked to olefins. Thus, in order to produce gasoline from olefins, one reaction takes place —polymerization. In order to produce liquids from paraffins, two reactions take place — one a cracking and dehydrogenation followed by polymerization and other effects.

It should be pointed out that to produce olefins from paraffins high temperature must be used, while polymerization of olefins gives out heat at low temperatures once the reaction is started. To crack paraffin gases and polymerize the olefins formed calls for opposing reactions, and therefore the conditions best suited for olefin formation are not suitable for the polymerization reaction.

From a theoretical and practical standpoint it is best to produce the olefin gases under op-

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timum conditions and then polymerize the olefins to liquids under the most suitable conditions. Investigators have obtained liquids from the cracking of paraffins, but Sullivan, Ruthruff and Kuentzel stated that "Experiments indicated that such one-step processes were inferior to the two-step process".

The flow chart of the Universal Oil Products Co. Catalytic Polymerization Process as shown in Fig. 1 is that of a commercial unit in operation. The cracked gas being processed is derived from the top of a stabilizer column connected to a gasoline reforming unit. The unit was designed to treat 3,000,000 cu. ft. per day of a 25 per cent olefin gas. The gas which is available at 175 to 200 pounds pressure passes through a heater where its temperature is raised to 400° F. and then in series flow through three or four catalyst towers directly under the stabilizer pressure.

The polymer vapors pass through a condenser to a receiver where the lean gas is separated from the gasoline. The polymer gasoline is pumped to a stabilizer where the desired vapor pressure may be obtained.

The polymerization reaction is an exothermic one and a temperature rise of 100° F. or so may occur. The conditions are so controlled that the polymer gasoline has a boiling range of from 100° to about 410° F. at 10 pounds Reid vapor pressure.

In a 23-day run on commercial stabilizer gas and when processing at the rate of 2,600,000 cu. ft. per day (all the gas available) the average olefin content of 27 per cent gave a yield of 5.2 gallons 10 lbs. Reid vapor pressure gasoline per 1000 cu. ft. of gas or at the rate of 13,600 gallons per day or a total of 313,000 gallons. The octane rating, A. S. T. M. Motor Method, was 81 or on a blending value basis 115.

The product of the catalytic polymerization process is a gasoline of constant quality. It has a blending value of from 103 to 125 as compared to benzol of 84 to 91 and isooctane of 94 to 99, using the same concentrations in the same gasolines as shown in Table 3.

Table 4 lists the octane numbers of various blends of steam-distilled polymer gasoline (E. P., 390° F.) with straightrun gasoline.

The blending value of polymer gasoline is substantially higher than benzol, hence should command a higher market value. It is reported that benzol motor fuel markets at 11 cents per gallon at the coal carbonization plants or steel plants.

The raw materials for the polymerization process are available in huge quantities at

Table 3

Octane Blending Value of Polymer Gasoline

(A) Polymer Gasoline Blends

Per Cent of Polymer Gasoline in Blend	5	10	15	20	25
Octane Blending Value:					
In 45 Octane Number Base Fuel	125	125	121	120	117
In 55 Octane Number Base Fuel	125	120	115	113	111
In 65 Octane Number Base Fuel	105	105	105	105	103

(B) Benzol Blends

Per Cent of Benzol in Blend	5	10	15	20	25
Octane Blending Value:					
In 45 Octane Number Base Fuel	84	85	84	84	86
In 55 Octane Number Base Fuel	84	85	88	90	89
In 65 Octane Number Base Fuel	84	85	88	90	91

(C) Isooctane Blends

Per Cent of Isooctane in Blend	5	10	15	20	25
Octane Blending Value:					
In 45 Octane Number Base Fuel	94	94	94	96	96
In 55 Octane Number Base Fuel	94	94	95	98	99
In 65 Octane Number Base Fuel	94	94	95	97	97

(D) Octane Numbers

Polymer Gasoline	81
Benzol	97
Isooctane	100

Table 4

Octane Ratings of Blends of Polymer and Straight-Run Gasolines

Octane Ratings of Blends of Polymer and Straight-Run Gasolines

Polymer Gasoline in Blend, %	100	0	5	10	15	20	25
Straight-Run Gasoline in Blend, %	0	100	95	90	85	80	75
Octane Number of Blend (A. S. T. M. Motor Method)	81	44	48	52	56	59	62

Table 5

Analyses of Refinery Gases (Per Cent by Volume)

Charging Stock	Receiver Gas	Stabilizer Reflux		Stabilizer Gas		Lean Gas	"BB" Fraction			Butanes-Butenes from Stabilizers			
Hydrogen (Non-Condensibles)	4.3	0.1	4.1	0.6	Trace	35.4	2.5	1.6	0.0	.....	.....	.....	.....
Methane	22.2	0.1	.....	3.4	.....	.....	.....	.....	.....	.....	.....	.....	.....
Ethylene	6.0	0.6	.....	16.0	1.1	4.7	.....	.....	.....	.....	.....	.....	.....
Ethane	17.3	3.2	.....	17.8	9.4	20.2	.....	.....	.....	.....	.....	.....	.....
Propene	11.2	16.6	11.8	29.0	18.9	7.5	.....	0.5	.....	.....	.....	.....	.....
Propane	26.8	16.8	28.8	22.2	47.1	18.0	.....	2.1	.....	.....	.....	.....	.....
n-Butenes	4.0	20.2	11.6	4.9	3.9	2.6	24.0	37.1	36.1	28.7	22.1	23.1	19.3
i-Butene	4.0	20.2	8.3	4.9	7.6	1.6	20.0	15.0	11.5	12.4	16.0	19.0	8.9
n-Butane	5.6	40.5	35.4	2.0	11.1	7.1	51.9	17.3	52.4	58.9	61.9	57.9	68.4
i-Butanes	5.6	40.5	35.4	2.0	11.1	7.1	51.9	24.4	52.4	58.9	61.9	57.9	68.4
Butadienes	.....	.....	.....	2.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pentane	0.2	1.2	.....	0.2	.....	.....	.....	.....	.....	.....	.....	.....	.....
Carbon dioxide + Nitrogen	1.6	0.5	.....	0.4	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hydrogen sulfide	0.8	.....	.....	0.2	.....	.....	.....	.....	.....	.....	.....	.....	.....

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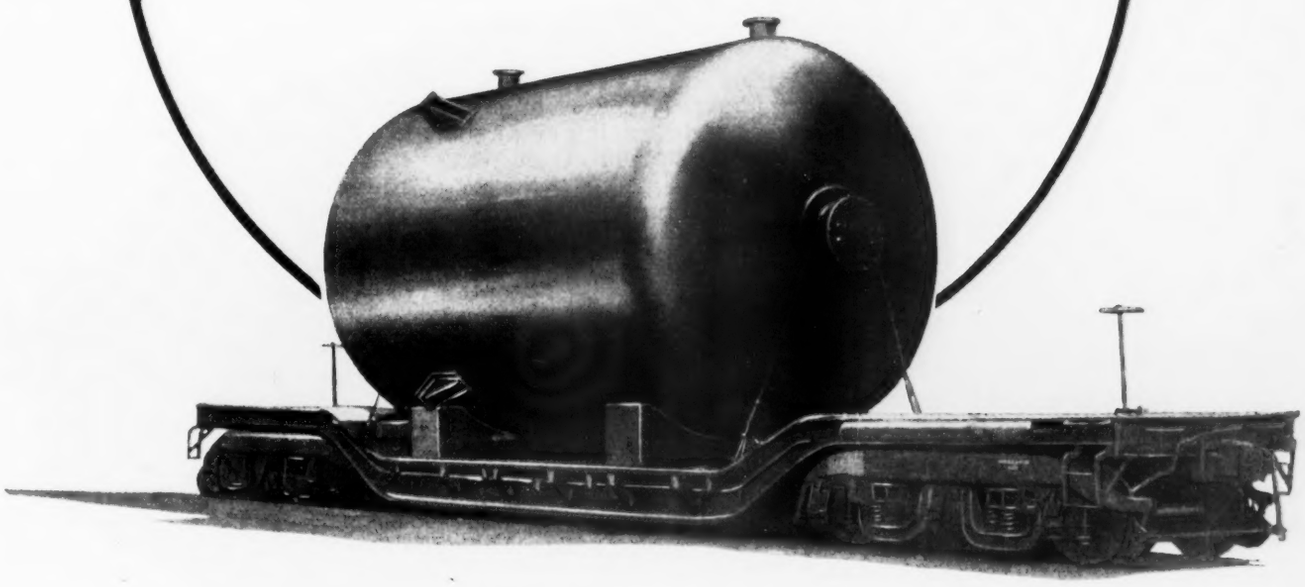

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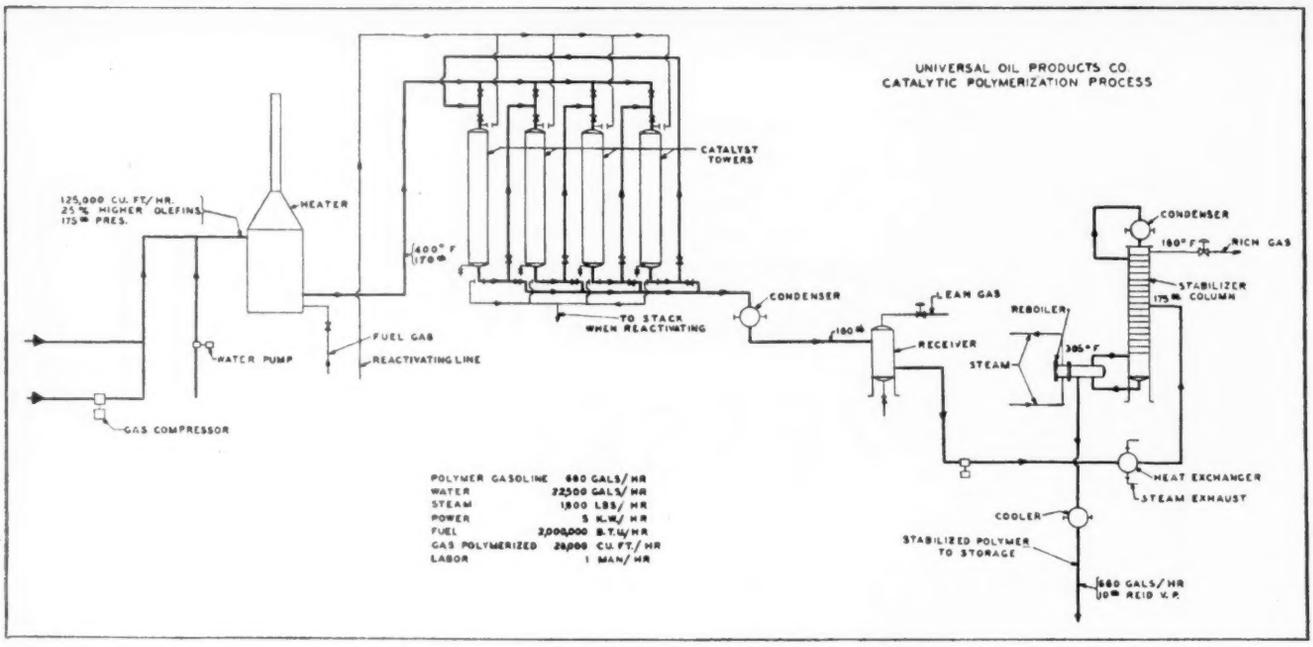

Flow chart of Universal Catalytic Polymerization Process

relatively low cost since they are cracked refinery gases. The yields of polymer gasoline are a function of the amount of olefins present in the gas. Analyses of various cracked gases are given in table 5. They were derived from the cracking units from the receiver, and various parts of the stabilizer for the cracked gasolines. The polymer gasoline of 10 lbs. Reid vapor pressure ranged in yield from 2.5 to over 10 gallons per 1000 cu. ft. of gas.

The gases available for polymerization contain olefins and paraffins. After these mixtures pass through the polymerization process a residue gas made up of paraffin hydrocarbons is left. These gases, such as propane and butanes, can be dehydrogenated or cracked to yield olefin gases which are readily polymerized.

The catalytic polymerization process is simple and flexible. The boiling range of the polymer gasoline is a function of the operating conditions and any olefin-containing gas can be made to produce a product boiling within the gasoline range. On the other hand, the octane value remains in the 80-82 range.

The polymer gasoline has a low oxygen bomb stability but high susceptibility to inhibitors. Table 6 lists the gum, oxygen bomb stability, antiknock and other characteristics of four typical crude polymer gasolines as produced from stabilizer gas.

The mild conditions for the operation of this catalytic polymerization process mean lower installation, operation and maintenance costs than under the severe conditions of 950° to 1300° F. and of pressures from 800 to 3000 lbs. per sq. in. processes. However, the cost of the catalyst must be added in order to obtain an overall cost. The "solid phosphoric acid" catalyst is cheap and readily produced from materials that are available in large quantities. It is a hard, rugged, active, non-corrosive granular solid that is neither

Table 6

	1	2	3	4
Gravity, °A. P. I. @ 60° F.	65.9	68.0	68.1	67.8
Gum, mg./100 cc. (Copper Dish)	15	34	38	44
Gum, mg./100 cc. (A. S. T. M.)	4	11	6	8
Induction Period, Minutes	35	60	50	45
Ind. Per. + 0.01 % Wood Distillate Inhibitor		260	205	305
Ind. Per. + 0.025% Wood Distillate Inhibitor	235	660	510	595
Ind. Per. + 0.05 % Wood Distillate Inhibitor	430	1030	835	845
% Sulfur, Total	0.77	0.02	0.02	0.04
% Sulfur. Mercaptan	0.54	0.002	0.007	0.006
Octane Number (C. F. R. Motor Method)	80	80	81	81
Octane Blending Value (25% in Fuel A-3; O. N., 44; C. F. R. Motor Method)	114	116	120	120
Reid Vapor Pressure @ 100° F., Lbs.	9.4	10.8	10.5	8.6
100 cc. A. S. T. M. Distillation				
I. B. P. Per Cent Distilled Over	**°F. 115**	**°F. 100**	**°F. 102**	**°F. 107**
5	146	125	148	132
10	160	143	156	152
20	184	177	178	180
30	199	193	196	196
40	209	203	205	206
50	219	211	214	212
60	232	221	222	219
70	254	236	243	235
80	294	266	270	261
90	337	326	336	326
E. P.	409	418	418	409
Total Per Cent Over	94.5	97.0	97.0	97.0
Per Cent Bottoms	1.5	1.4	1.5	1.5
Per Cent Loss	4.0	1.6	1.5	1.5

★

ANNOUNCEMENT

The M. W. KELLOGG COMPANY has been appointed Licensing Agent for THE POLYMERIZATION PROCESS CORPORATION and is prepared to discuss your requirements and submit proposals for plants for production of motor fuel by polymerization of refinery or natural gases. Plants will be licensed under the polymerization patents and patent rights of:

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poisoned by carbon monoxide, hydrogen sulfide, mercaptans, nor other constituents of refinery gases. In actual practice it gradually loses its activity due to the formation of high molecular weight substances but readily regenerates to its original or higher activity. The cost of the regenerating operation is low because it consists in burning the high-polymer hydrocarbons by controlled air oxidation without removing the catalyst from the tower.

Another outstanding development in the oil industry has been the commercial production of 100-octane gasoline by catalytically polymerizing isobutylene present in cracked gas derived from stabilizing cracked gasoline. The isobutylene is polymerized into diisobutylene which is hydrogenated to isooctane. This type gasoline was tested out in airplanes and found to be far superior to any other gasoline ever produced. It permits of speedier takeoff from the ground, greater speed in the air, and tests showed an increase in pursuit airplanes from 175 to 210 miles per hour. A commercial plane was able to carry two more passengers by the use of isooctane gasoline.

The developments of catalytic polymerization are such that one can rest assured that isooctane gasolines will be commercially produced in huge quantities at a price level which will be relatively low.

Aside from the production of high octane number and blending value gasoline, the catalytic polymerization process will be an important advance toward the production of chemically-controlled isooctane gasoline. Other factors being equal, the chemical differences in gasoline cause a variation in performance and there is no doubt that the automotive engineer can build a more efficient power plant if provided with a constant composition gasoline with relatively few hydrocarbons present.

The gaseous hydrocarbons available in the United States are a potential supply of over 1,000,000,000 gallons of isooctane gasoline a year, or more than 15 times the total consumption of aircraft fuel in the United States in 1934.

The catalytic polymerization of cracked gases has been in commercial operation for some time. There are in operation, design or construction at the present time, units of 3,000,000, 4,250,000, 4,500,000 and 27,000,000 cubic feet capacity of cracked gas per day, which will produce about 60,000,000 gallons of 81-octane polymer gasoline a year.

From the present outlook many polymerization units will be installed to profoundly affect the economics of the oil, the natural gasoline and gas, the aircraft and motor car, the tetraethyl lead and benzol industries.

Metropolitan News Photo

Dr. C. R. Wagner, chief chemist of Pure Oil Co., boarding a plane for a speedy trip to Detroit. Dr. Wagner is prominent among petroleum technologists, especially in the development of polymerization processes, which are being used to produce much better aviation fuels than those heretofore producible on a commercial scale, to meet the requirements of tomorrow's aviation engines

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NATIONAL PETROLEUM NEWS, July 24, 1935.

Variation in Operating Conditions Change Properties of Polymerized Fuel

By M. B. Cooke,* H. R. Swanson,* and C. R. Wagner**

Theory

THE demand for anti-knock fuel has been so great during the past few years that oil technologists have been searching intensively all possible methods and sources of supply. This study has been accelerated more recently by the demand for fuel for high-compression super-charged aviation motors with octane ratings far above anything which has been considered heretofore. Various schemes for cracking heavy oils have been proposed, and thousands of chemicals have been tried with the idea of their use as "dopes" to increase the anti-detonating characteristics of gasoline. Little attention has been directed toward the gases produced as a by-product from

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cracking operations, a prolific source of valuable anti-knock fuel.

Polymerization, and its aplication to hydrocarbon chemistry known for many years, may be defined as the union of two or more molecules of a substance to form a larger molecule, the latter being called a "polymer." Polymerization is sometimes incorrectly referred to as condensation. The olefins of low-molecular weight, viz., ethylene, propylene, butylene, etc., form polymerization products when subjected to heat and pressure without catalysts.

The significance of the polymerization of gaseous olefins is the production of gasoline-like hydrocarbons which, due to modern internal-combustion-engine designs and demands for fuel, serve as desirable fuels, or blending fuels, due to their inherent anti-detonating characteristics when used in such engines.

A search of the literature on polymerization reveals that there have been two plausible theories or explanations of the mechanism of polymerization of

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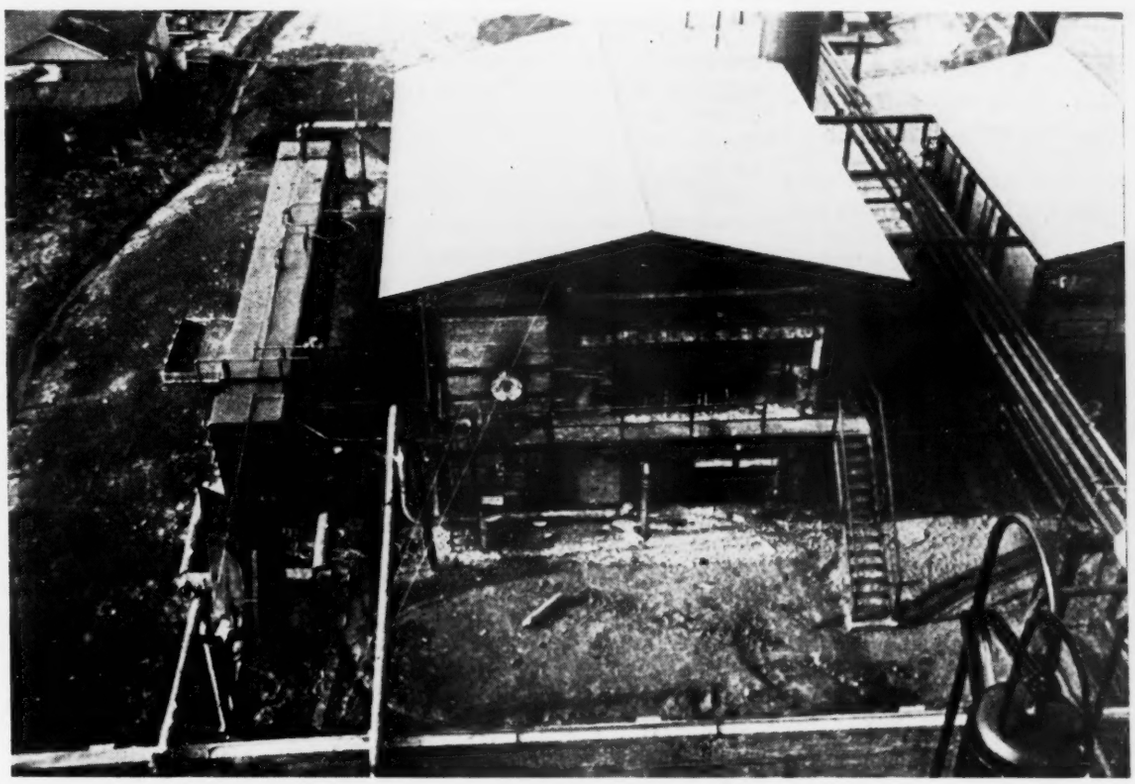

Fig. 7. The 5,000,000 cubic feet capacity polymerization unit built by Alco Products, Inc., at Shreveport, La.

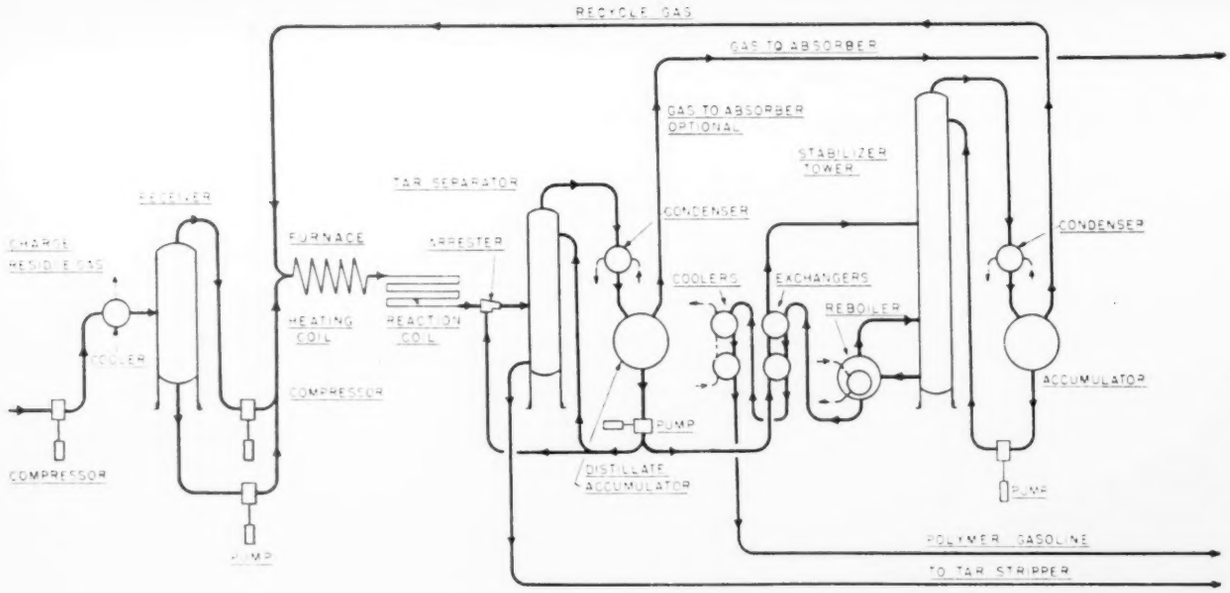

Fig. 2. Flowchart showing the essentials of operation of a high pressure, low temperature polymerization unit, charging residue gas

unsaturated hydrocarbons. The first theory was proposed when technologists were studying the mechanism of sulfuric-acid refining of hydrocarbon oils containing unsaturates, viz., that sulfuric acid forms first an acid ester or alkyl sulfuric acid by addition; this addition product subsequently reacts with another molecule of the olefin to form the polymer. The sulfuric acid is liberated, and theoretically may go through many cycles. If *iso*-butylene is polymerized as the olefin, di*iso*butylene (*iso*-octylene) would be obtained, which has twice the molecular weight of the raw material, butylene. The second theory is called the partial-valence theory. According to this theory the doubly-linked carbon atoms have partial valences or "residues of free affinity." The further assumption is made that the molecules contain a mobile or labile hydrogen atom (the assumption of a labile hydrogen atom has been made to explain many reactions) which shifts from one molecule to the other, thus permitting polymerization. This explanation may account for polymerization in the presence or absence of catalysts where no addition compounds are formed.

According to either of the above theories, two unlike molecules may also react — thus explaining the formation of all the higher polymers.

The above characterizes in general, from a broad chemical viewpoint, the process of polymerizing light hydrocarbons. The opinions with respect to the reaction mechanism of the conversion of specific constituents are divergent, and it is not considered within the scope of this article to discuss this in detail.

From an equipment-design standpoint, theoretical consideration of the kinetics of the reaction are of importance. Polymerization is generally assumed to be a bi-molecular or second-order reaction. The reaction-velocity constant, k, is expressed by the equation:

$$k = \frac{x}{at(a-x)}$$

Where:

t = the reaction time

a = the reactant at the beginning of the reaction (t=0), and

x = the part of the original reactant which is converted in the time *t*.

A consistent correlation of data will establish the values of the reaction-velocity constant as a function of the reaction temperature for any constituent. Correct and consistent reaction-velocity data are the prime requisite for the design of equipment of this type.

In the earlier literature on pyrolysis of hydrocarbons, the opinion is expressed that aromatics are only formed at extremely high temperatures — temperatures considerably above those to be disclosed as proper and sufficient in this article. Free-energy relationships, however, indicate that aromatics are formed from certain olefins of low molecular weight at as low a temperature as 800° F. The older literature referred to above mentions temperatures in the order of 1,500-2,000° F. When polymerizing at comparatively low temperatures and high pressure, the simple junction of molecules with the least disturbance of the existing carbon-to-carbon and carbon-to-hydrogen linkages seems to prevail, while at higher temperatures a complete re-arrangement seems to take place leading to the formation of cyclic compounds. The high-temperature polymerization condensate is almost completely aromatic.

Heretofore attempts to form aromatics from low-molecular-weight hydrocarbons have been largely confined to pyrolysis of paraffin gases, an endothermic process. We are discussing here a process for polymerizing olefins, an exothermic reaction. It is, therefore, possible that local points of very high temperature exist at the time of formation of aromatic molecules, but the surrounding gases conduct the heat away rapidly enough to

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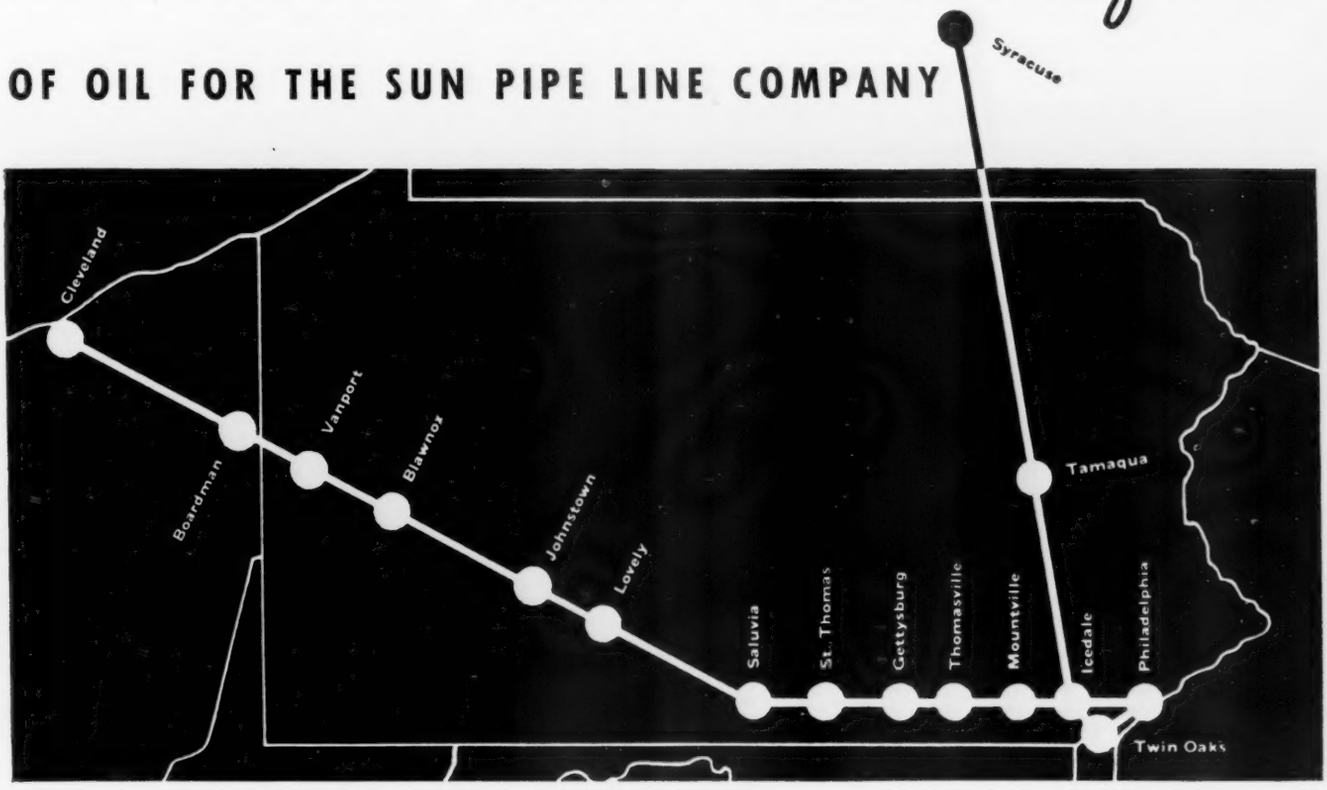

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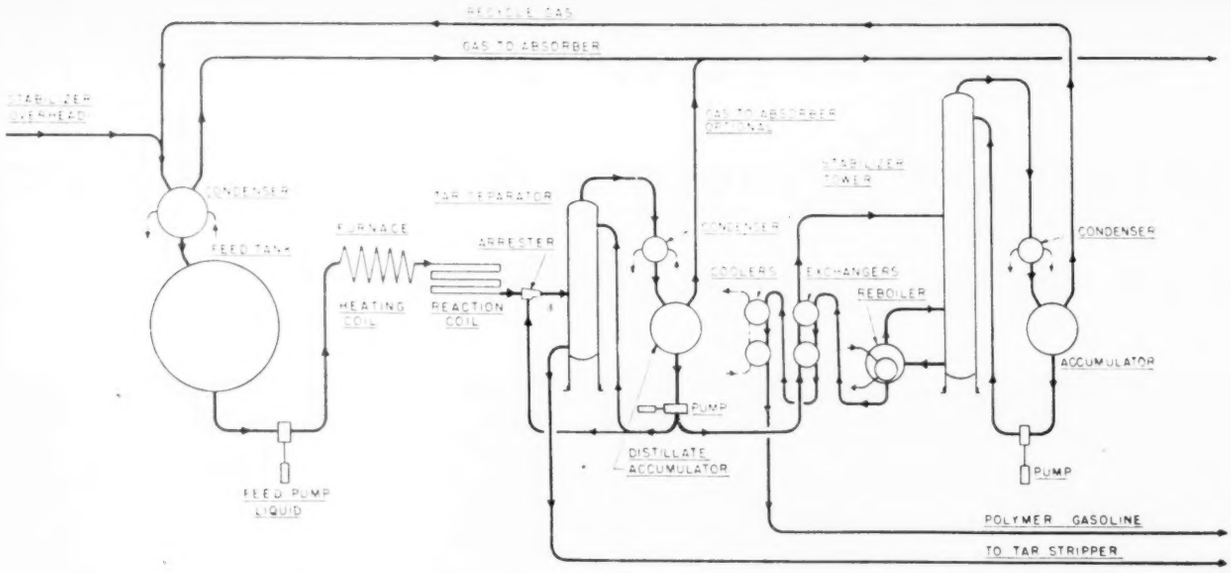

Fig. 3. High pressure, low temperature polymerization flowchart, charging liquid

maintain a lower average temperature.

Refinery Operating Economy

The polymerization of olefinic gases for the production of low-sulfur aromatic compounds is destined to increase in importance. High anti-knock-value gasoline, or gasoline-blending material — as well as benzol, toluol, and xylol — can be made with good yields, and at a profit, at the present time. The trend of refinery cracking has been, and still is, from low temperatures (liquid-phase cracking) to higher temperatures with a corresponding decrease in pressures. This tendency has resulted in an ever-increasing gas yield of higher unsaturation.

This is ideal for polymerization, as an otherwise wasted (or nearly so) by-product — gas — becomes a valuable charging stock. The refiner can now install a polymerization plant, and the cost of it can be paid for, in one year or less, out of its earnings. The average refiner can increase his cracked-gasoline output by polymerization by 15-20 per cent if he polymerizes all his cracking-still gases. This material has a very high blending value, and can be made either high in volatility or low in volatility. This flexibility gives the choice of employing high percentages of butane in the blended gasoline; or, if the material available for blending has low volatility, the necessary volatility may be obtained to a large degree from high-volatility polymer gasoline.

The equipment for carrying out the process is similar in appearance, operation, and instrumentation to cracking-still equipment — and for this reason few additional men are needed if the polymerization plant is installed close by, or in conjunction with, the cracking stills. Treating of the distillate is no different from treating other gasoline distillates, and no special processes are necessary.

On the contrary, most polymer distillate is lower in sulfur content than cracked or straight-run gasoline.

The most logical program to follow in this country in adopting polymerization consists of installing plants first to polymerize vapor-phase cracking-still gases. These are rich in unsaturates, and are amenable to polymerization at a very reasonable cost. By including a pyrolysis step, a very high ultimate yield of polymer gasoline is obtainable from this source of raw material. The liquid-phase cracking-still gases are, in general, rich enough in unsaturates to merit one step of polymerization before a pyrolysis step.

A second source of polymerization raw material is the huge quantity of natural-gasoline tops and natural gas which is available. Natural gasoline tops will yield high percentages of polymer gasoline when dehydrogenated and polymerized. Natural gas can be used as a raw-charge material for polymerization, but the yield of gasoline is less.

When it is considered that our gasoline production can be increased from 10-25 per cent (of our total consumption) from the same amount of crude oil per day, it is highly important that this conservation step be pushed and encouraged most vigorously.

Charging Stocks Available

Commercially-feasible charging stocks for gas polymerization for the production of motor fuel contain hydrocarbons varying from the lowest member of the paraffin series, methane (CH_4), to the normally gaseous butylenes of four carbon atoms. The methane group is found in refinery gases, and constitutes the major portion of natural gas. The modern polymerization plant can utilize any of this raw material in such a way that the gasoline produced will be a very substantial part of the total gasoline production.

The gases available as charging stock may be divided into three main classes, for convenience in arriving at yield figures. The most easily polymerizable gases are formed in the vapor-phase cracking of hydrocarbon oils. In this country there are approximately 90 plants, each of which yields an average of 1.2 million cubic feet of highly-unsaturated gases

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per day. Since the unsaturated content is high, no pyrolysis of the gases before the polymerization operation is necessary. Table 1 shows analysis of typical residue gases from a vapor-phase cracking system.

TABLE 1

ANALYSIS OF GYRO VAPOR-PHASE GAS

Constituent	Sample No. 1 (Mol Per Cent)	Sample No. 2 (Mol Per Cent)
$CH_4(+H_2)$	32.5	37.9
C_2H_4	23.9	25.6
C_2H_6	13.4	13.8
C_3H_6	16.8	16.8
C_3H_8	4.9	3.1
C_4H_8	6.1	2.8
C_4H_{10} and heavier	2.4	
Specific gravity (air = 1)	1.035	0.95

Typical comparisons of the overhead from a stabilizer, working in conjunction with a Gyro vapor-phase cracking and compression-gasoline recovery system, are given in Table 2.

TABLE 2

ANALYSIS OF STABILIZER OVERHEAD

Constituent	Sample No. 1 (Mol Per Cent)	Sample No. 2 (Mol Per Cent)
CH_4+H_2	0.5	1.2
C_2H_4	9.2	7.1
C_2H_6	8.3	7.8
C_3H_6	40.3	37.6
C_3H_8	10.4	11.6
C_4H_8	28.4	30.5
C_4H_{10}	2.6	3.4
C_5 and heavier	0.3	0.8
Unsaturates	77.9	75.2

The amount of stabilizer gas in per cent of the total residue gas will vary considerably, depending upon the method of gasoline recovery employed in connection with the vapor-phase cracking system.

The above gases may be handled in two ways:

a. Compressed and charged as compressed gases to the polymerization coil (see Fig. 2);

or

b. A major portion of the residue gas may be recovered as stabilizer overhead in liquid state and pumped to the polymerization unit (see Fig. 3).

When charging a gas of the composition shown in Table 1 (vapor-phase cracking gas) the entire gas is compressed to 600-800 lb. pressure and heated to 900-1000° F. in a pipe-coil heater.

The gas is soaked in a reaction chamber which may take the form of a coil, which is cooled in order to absorb the exothermic heat of reaction, and then chilled by injection of either cold gas or oil. The reaction is checked at about 60-70 per cent conversion, necessitating a re-circulation ratio of about 1.5.

The mixture is fractionated, and the liquid product stabilized —giving a yield of gasoline of about 3.25 gal. to 4.5 gal. per 1000 cu. ft. when operating under these conditions. The data obtained from a typical run are given in Table 3.

These data reveal that about 28 per cent of the residue gas from the vapor-phase cracking unit is converted to polymer gasoline when operating under the conditions outlined.

We estimate that there are 90 vapor-phase cracking units in the United States with an average capacity of 1000 bbl. per day of reduced crude. The gas produced from these units amounts to approximately 100,000,000 cu. ft. per day. If this quantity of gas were polymerized, with yields of E.P. gasoline conservatively estimated at 3.25 gal. per 1000 cu. ft. of gas charged, there would be produced 325,000 gal. or 7800 bbl. per day. This polymer gasoline contains about 25 per cent of aromatics, is highly volatile, and has an octane value, by the ASTM method, of 78-80, and a blending value of 96.

This process does not produce the maximum of aromatics. In order to produce the maximum aromatic content, it is necessary to operate under other temperature-pressure conditions as described later.

TABLE 3

Charging Stock:	
Residue gas from Gyro vapor-phase cracking system:	
Specific gravity (air = 1)	1.06
Unsaturates, per cent	47.2
Yields of Products:	
Treated gas:	
Cubic feet per cubic foot of charge	0.80
Specific gravity (air = 1)	0.87
Unsaturates, per cent	18.4
Liquid:	
Gallons per 1000 cu. ft. of chg.	4.4
E. P. Gasoline:	
Gallons per 1000 cu. ft. of chg.	3.7
Gravity, API	52.4
Per cent of total liquid	84
ASTM Distillation of E.P. Polymer Gasoline in Deg. F.	
Initial boiling point	96
10-per-cent point	134
50-per-cent point	220
80-per-cent point	302
End point	420

The alternative operation mentioned above consists of utilizing to the utmost the advantages of liquid charging stock for the polymerization operation. In this operation the gases from the vapor-phase cracking operation are processed to eliminate the lower-molecular-weight saturates (C_1 and C_2) so far as is practical, and to concentrate the active olefins. Many advantages result from this procedure: 1, lower power costs due to the great reduction in horsepower for compression of gases in charging the polymerization unit; and, 2, the reduction in the plant investment due to reduction in size of the several pieces of equipment as a result of eliminating the inactive gas from the cycle. A third, and very worthwhile, advantage is realized at the same time in that the uniform control of the polymerization reactions becomes very simple.

The process of preparing the charging stock consists either in absorbing the higher-molecular-weight constituents of the cracked gas and recovering them from the absorbing medium under high pressure as a liquid, or in separating and fractionating directly under pressure — requiring compression of the cracked gas and fractionation of the condensed portion. When using these methods, the amount of ethylene in the charging stock is relatively small, since it would require very high pressures or low temperatures to get it in the liquid phase. However, the gasoline yield is only slightly reduced, since ethylene polymerizes too far — forming tar if the reaction is carried out at the proper temperature for the propylene-butylene reaction. The temperatures and pressures employed are within the same ranges as given in the case of the gas-charging operation. Typical data of the liquid-feed operation are found in Table 4.

High-Temperature — Low-pressure Polymerization

By the high-temperature — low-pressure method of operation, good yields of gasoline can be obtained. The gas is com-

pressed to feed pressure and heated. Temperatures existing in the reaction coil range from 1150 to 1300° F., and pressures are in the order of 50 to 75 lb. per sq. in., gage.

Operating on absorber gas, the unsaturates in the gas are predominantly ethylene, and give yields of distillate from 3 to 4.5 gal. per 1000 cu. ft. employing re-circulation as indicated by the test data in Table 5.

The yield of distillate at the rate of conversion obtained in cyclic operation would be approximately 4.0 gal. per 1000 cu. ft.

Operating on stabilizer overhead, the unsaturates in the charge are mostly propylene and butylene, and yields of distillate from 8 to 12 gal. per 1000 cu. ft. are obtained as indicated by the test data in Table 6.

The yield of distillate for cyclic operation would be approximately 11.0 gal. per 1000 cu. ft. The percentage boiling up to 350° F. can be increased by operating at a lower rate of conversion per pass.

The yield of distillate seems to be somewhat higher for the low-temperature — high-pressure operation than for the high-temperature — low-pressure operation when operating on the same charging stock, but the yield depreciation is more than compensated for by the appreciation in quality.

In the high-temperature operation a gasoline of 85-105 octane No. (ASTM) is obtained. The octane-blending value is approximately 105-125. The polymer produced is almost entirely aromatic; and the volatility, of course, is low. The low volatility is a very desirable feature in many instances, inasmuch as the octane number of the blended gasoline may be very much increased without removing any butane before blending with polymer gasoline.

To obtain the maximum polymer gasoline possible from a given quantity of by-product gases, a combination of pyrolysis and polymerization steps seems to be ideal. This system gives the maximum yield of high-quality polymer gasoline from charging stocks which originate from gasoline-cracking stills of the liquid-vapor-phase types. In the case of liquid-vapor-phase gas, it is estimated that there are produced 1,000,000,000 cu. ft. per day. If this high-temperature — low-pressure combination system were used, there could be produced over 1,200,000,000 gal. per year of 100-octane gasoline. This distillate is 80 to 85 per cent aromatic. Therefore, there could be produced over 1,000,000,000 gal. of relatively pure aromatics per year, or 24,000,000 bbl. per year.

TABLE 4

LIQUID-FEED POLYMERIZATION OPERATION

Commercial plant handling 4,050,000 cu. ft. (standard) per day. Average operation, Sept. 1 to Sept. 20, 1934.

Charging Stock (Including Recycle):	
Specific gravity (air = 1)	1.51
Unsaturates, mol per cent	49.4
Conversion of unsaturates, per cent	86.7
Re-cycle ratio	1.75
Yield and Properties of Products:	
E.P. gasoline:	
Gallons per 1000 cu. ft. of fresh charge	8.8
Gravity, deg. API	55.0
Octane No., ASTM	76.0
ASTM Distillation in Deg. F.	
Initial boiling point	90
10-per-cent point	105
30-per-cent point	145
50-per-cent point	182
90-per-cent point	323
End point	398
Fuel oil:	
Gallons per 1000 cu. ft. of fresh charge	3.0
Gravity, deg. API	8.0
Treated gas:	
Specific gravity (air = 1)	1.01
Unsaturates, mol per cent	22.0

TABLE 5

Operating Conditions:	
Once-through operation:	
Temperature of coil outlet, deg. F.	1275
Pressure of coil outlet, lb. per sq. in., gage	60
Conversion, per cent	37.4
Charging Stock:	
Specific gravity (air = 1)	0.79
Unsaturates, per cent	39.4
Distillate Made:	
Gallons per 1000 cu. ft.	1.75
Gravity, deg. API	21.6
Percentage boiling up to 350 deg. F.	76
Octane No., ASTM	102
Treated Gas:	
Cubic feet per cubic foot of gas charged	0.85
Specific gravity (air = 1)	0.72
Unsaturates, per cent	29

TABLE 6

Operating conditions:		
Once-through operation:		
Temperature of coil outlet, deg. F.	1175	
Pressure of coil outlet, lb. per sq. in., gage	55	
Conversion, per cent	80	
Charging Stock:		
Specific gravity (air = 1)	1.352	
Unsaturates, per cent	79.6	
Distillate Made:		
Gallons per 1000 cu. ft.	9.8	
Gravity, deg. API	26.4	
Percentage boiling up to 350 deg. F.	68	
Octane No., ASTM	86	
ASTM Distillation in Deg. F.:	Distillate	350 E.P. Gasoline
Initial boiling point	118	120
10-per-cent point	184	172
30-per-cent point	218	190
50-per-cent point	256	204
70-per-cent point	368	224
90-per-cent point	.....	267
End point	.....	352
Treated Gas:		
Cubic feet per cubic foot of gas charged		0.46
Specific gravity (air = 1)		0.86
Unsaturates, per cent		34.5

A simple illustration of a high-temperature process, comprising a pyrolysis and a polymerization step, is given in Table 7 (natural gas as the original charging stock is used).

The treated gas is lower in gravity and has a lower heating value, which makes it more desirable for use as a domestic or other heating gas.

Natural gas produced in this country in 1933 amounted to 1,555,474,000,000 cu. ft. The figures for 1934 are not yet available, but are probably higher. In 1932 there were produced 2,555,000,000,000 cu. ft. Taking the 1933—and more conservative—figures as a basis for figuring the potential polymer gasoline, and assuming the average composition to be the same as given in Table 8, we could obtain 2.1 gal. of 350-E.P. distillate per 1000 cu. ft., or 2.1 × 1,555,474,000 = 3,270,000,000 gal. per year (77,800,000 bbl. per year). There would still remain 1,414,000,000,000 cu. ft. for domestic or industrial use as a heating medium.

The potential yield of polymer gasoline from refinery and natural gas in this country, utilizing the thermal process with efficiencies obtainable at this time, amounts to approximately 110,000,000 *bbl. per*

year, or roughly 25 per cent of the total gasoline consumed in the United States during the year 1934. The octane value is higher than that obtained by any other known thermal or catalytic process for producing gasoline. Only tetraethyl lead may be considered a competitor for enhancing the anti-knock value of gasoline — and this material does not increase the *amount* of gasoline to be used as fuel, but only alters and improves the anti-knock quality.

Types of Polymerized Distillates

The character of the distillates produced varies widely with the operating conditions employed. The distillate obtained by the high-pressure—low-temperature method of operation is comparatively volatile, and would only have the maximum blending value if the other component of the blend is lacking in volatility. On the other hand, the high-temperature polymerized distillate is almost entirely aromatic—and the volatility, of course, is low. The low volatility is a very desirable feature in many instances, inasmuch as the octane number of the blended gasoline for a given Reid vapor pressure may be very much increased without removing any butane before blending with the polymerized stock.

Fig. 4 gives the distillation characteristics of typical polymer gasolines produced by various methods. The charging stock in all cases is a stabilizer overhead stock, similar in composition to that given in Table 2.

The data in Fig. 4 bear out important factors to be considered when selecting a polymerization plant.

TABLE 7

Charge:	
Specific gravity (air = 1)	0.815
Composition:	(Mol. Per Cent.)
CH_4	70.5
C_2H_6	12.7
C_3H_8	10.3
C_4H_{10} and heavier.....	6.5
Pyrolysis Gas:	
Specific gravity (air = 1).....	0.645
Composition:	(Mol. Per Cent.)
H_2	11.5
CH_4	62.5
C_2H_4	15.7
C_2H_6	5.1
C_3H_6	2.5
C_3H_8	1.2
C_4 and heavier	1.5
Liquid Made:	Gallons Per 1000 Cu. Ft. of Charge
Pyrolysis step	0.42
Polymerization	2.38
Total	2.80
Percentage boiling up to 350 deg. F.	75
Octane No., ASTM	104
Treated Gas:	
Cubic feet per cubic foot of gas charged.....	0.91
Specific gravity (air=1)	0.59

Multi-Coil Conversion System

A residue gas from a pressure liquid-vapor-phase cracking system, which is comparatively low in unsaturates, should be processed in a system involving three unit operations if the maximum yield of high-octane distillate is desired:

1. High-temperature — low-pressure polymerization of propylene and butylene.
2. Pyrolysis of gas remaining after the polymerization step.
3. High-temperature — low-pressure polymerization of the cracked gases.

Let us select a typical charging stock of this type as found in most refineries in the form of stabilizer overhead gases, which contain — we shall assume — only about 30 per cent of unsaturates. By polymerizing as a first step, we have the advantage that we can operate under the most favorable temperature and pressure conditions for the conversion of the propylene and butylene to polymer gasoline. The stabilizer overhead gases are already under pressure and, by proper cooling, are liquefied as a by-product of the stabilizing operation — thus eliminating the installation of large compressors to feed the polymerization unit. Fig. 5 shows the various phases of operation, and indicates the essential equipment.

In the primary polymerization step the charge is heated to the proper temperature, and enters the reaction coil which is designed to give the desired time-temperature effect. Cooling means is provided to keep the temperature within the proper limits. The reaction products, immediately upon leaving the coil, are chilled to stop any further reaction, and simultaneously are cooled to a temperature low enough so that heavier products will be dropped out in the tar separator. Gases, distillate vapors, and chilling medium forming the overhead from this separator are refluxed for end-point control. The total overhead passes to a cooler and accumulator where the chilling medium, polymerized distillate, and a portion of the gaseous constituents are condensed. The uncondensed gases and vapors from the accumulator are passed directly to the gas-pyrolysis unit.

A portion of the condensate from the accumulator is used as the chilling medium previously referred to; and the remainder, equivalent to the condensed products of reaction is pumped to the fractionating unit. In this unit the polymer distillate is stabilized to desired specifications, and all gaseous compounds — including excess C_4 constituents not desired in the finished distillate — are taken overhead and form additional feed to the gas-pyrolysis coil.

In the gas-pyrolysis coil the charge as recovered in the primary polymerization step is heated to a temperature in ex-

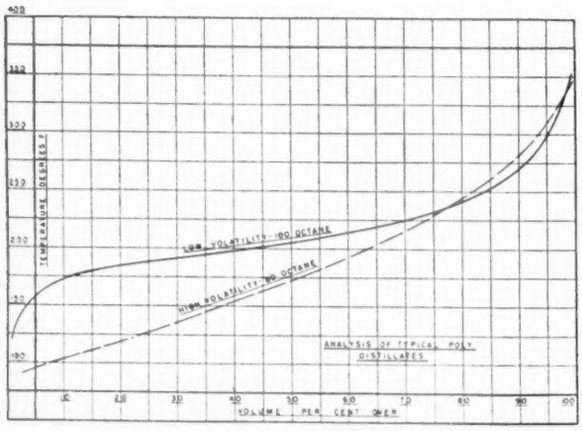

Fig. 4. Relationship between octane number and volatility in polymerized gasoline

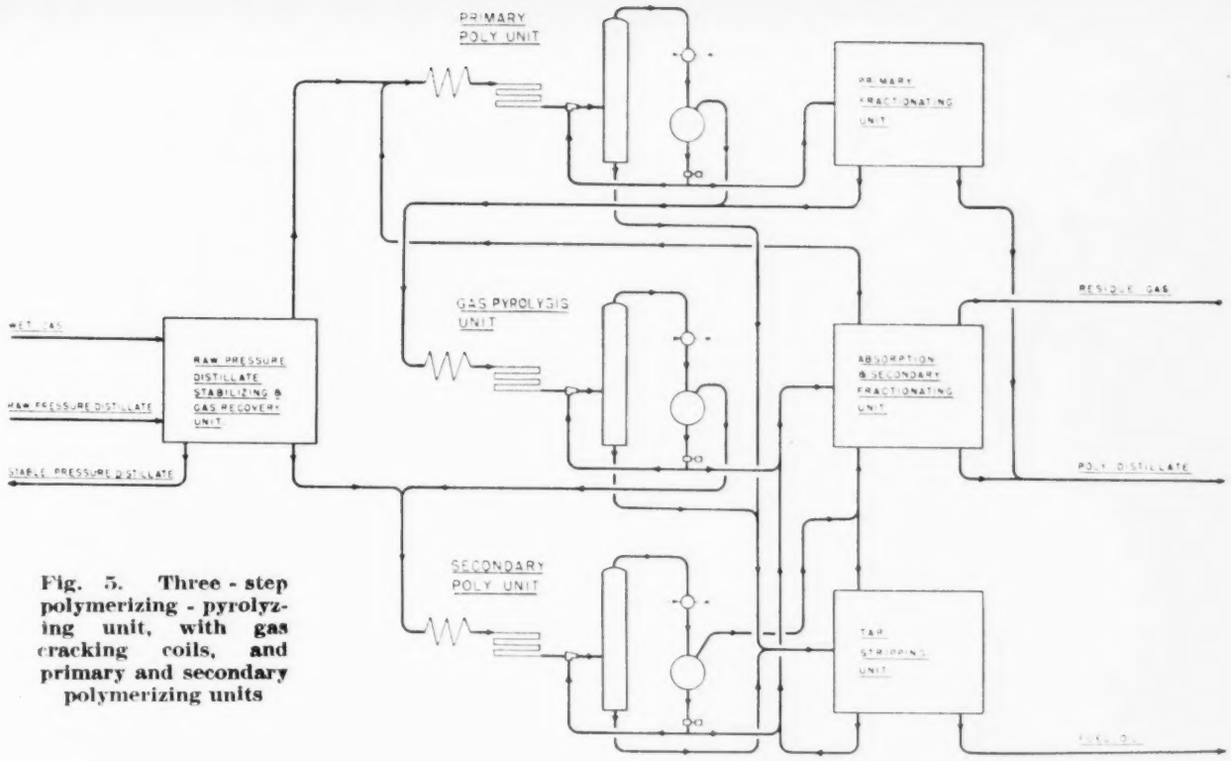

Fig. 5. Three - step polymerizing - pyrolyzing unit, with gas cracking coils, and primary and secondary polymerizing units

cess of 1300° F. A reaction time as short as possible is desired to prevent the unsaturates once formed from entering secondary reactions leading to the formation of tar. The products of reaction are chilled to a temperature low enough to liquefy compounds in the fuel-oil and tar range. Gases, distillate vapors, and vaporized chilling oil pass overhead from the tar separator to a condenser and accumulator, where the chilling material is condensed. The gas remaining after compression and cooling is charged to the secondary polymerization coil, and submitted to a high-temperature—low-pressure reaction. The chilling of the conversion product, tar separation, condensing of chilling medium, is analogous to the method used in the primary polymerization step. Since the reaction products contain a high percentage of hydrogen and methane, recovery of polymer distillate cannot be effected by condensation under the low operating pressure. Recovery may be accomplished by compression and subsequent condensation. However, in most cases it is believed that absorption will be more economical. All polymer distillate distilled from the absorption oil is accumulated and fed, together with the pyrolysis distillate, to the secondary fractionator. The bottom product from this unit is stabilized to desired specifications, and the light overhead material is passed directly under its own pressure to the primary polymerization unit as recycle.

The bottoms from the various tar separators are combined, heated, and then stripped of all fractions of gasoline of boiling range.

A unit of the type described above is very flexible, and insures the highest yield of distillate for charging stocks varying widely in composition.

Cost of Plants

It has already been mentioned that polymerization plants are similar in appearance and operation to cracking plants, especially so if the cracking plant is modern and is equipped with gasoline-recovery and stabilization units. The cost of construction and operation is likewise very nearly the same as it is for the modern cracking installation. The only other worthwhile item affecting the cost of producing polymer gasoline or aromatics is the value of the charging stock to the polymerization unit. In this case it is a residue gas and, in general, its cost is measured by its heating value, since it is used instead of other heat-producing products such as fuel oil. It is safe to assume, in the majority of cases, that the charge gas carries a value equal to fuel oil in a given locality. It should also be considered that gas from refinery operations cannot be shipped to market, in most cases, without purification —and then only if pipe lines are available. It appears entirely fair, therefore, to give the gas-charging stock a maximum value not exceeding heavy fuel oil. With this as a basis, it is found that polymer gasoline can be produced in this country at a cost not exceeding 5 cents per gallon at the present time.

If we consider the production of highly-aromatic polymer distillate, it is quite evident that we have the cheapest source of aromatics so far made available. The general conclusion to be drawn, as regards the economics involved, is that polymerization is a very attractive commercial process for refiners to install. As the demand for anti-knock fuel increases, the returns from polymerization likewise increase.

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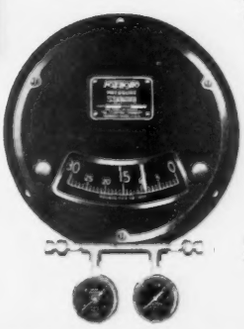

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Note: As originally presented this paper contained a list of the numbers of a group of patents covering polymerization. Since the patent situation is dealt with elsewhere in this issue and an exhaustive list of patents cited, the list prepared by these authors is not given here.—Editor.

S.O. California Plans Bahrein Refinery

SAN FRANCISCO, Nov. 14.—Standard Oil Co. of California today announced placement of orders for equipment for the construction of a refinery on the Bahrein Island, in the Persian Gulf, where the company has developed an oil field through its subsidiary, The Bahrein Petroleum Co. Initial unit of the refinery will have capacity of 10,000 bbls. daily, with equipment that will make it possible readily to double this capacity to 20,000 bbls. daily. The plant is expected to be in operation next July and will produce principally gasoline, kerosine, diesel oil and fuel oil.

Standard acquired an exclusive concession of 100,000 acres in Bahrein in 1930. Drilling was started in 1931 and oil was discovered in June 1932. Today there are 16 producing wells and 6 drilling. It is estimated that the field now has a potential production of 50,000 bbls. a day. Production has recently approximated 6500 bbls. daily. Products will be marketed in nearby territory and possibly in the Far East. Crude output so far has been marketed in the Far East, it is understood.

Apparently conferences between the Standard of California, Standard of N. J., and Royal Dutch-Shell group in New York last month, aiming at elimination of the Bahrein oil from world market competition, were unsuccessful, although officials of the California company declined to comment.

Imposing Patent Structure Already Developed to Cover Polymerization

By Arch L. Foster
N. P. N. Staff Writer

NO STUDY of the principles of hydrocarbon gas polymerization can be satisfactory without considering the patent structure that has been built up here and abroad. This group of patents probably covers fairly thoroughly the fundamental principles of the reactions involved in polymerization. While important patents may be expected to issue in the future, these in general will pertain to refinements of the process already developed with relatively few patents of a basic nature to be expected.

Below is given a list of 138 polymerization patents which may be considered the background and legal support for the three processes developed in America, as well as such polymerization processes as are used elsewhere, Germany and England in particular. While probably not entirely complete, the brief information given regarding the principle involved in each patent will furnish the refiner a comprehensive view of the claims of these various patents, and the organizations which have been most active in building up a patent structure covering one type or more of these processes.

Because of the newness of the commercial application of polymerization to refinery operation, and the importance of it in the production of motor fuel the strides made in 1935, in adapting processes and principles to commercial plants, outstrip in rapidity the development of any other refinery process, with the possible exception of solvent extraction processes for lubricating oils. No patents are listed which were issued prior to 1922.

Of the patents here given, 81 employ catalysts in one form or another; 57 are non-catalytic, or thermal, processes. The catalytic process is typified by the Universal process, as installed last winter by the Shell Petroleum Corp., at East Chicago, and another unit of which is completed or nearing completion in the Wood River, Ill. refinery of the same company. Two thermal processes have been commercially applied, that of the Gyro in connection with the cracking process of the same name; and that operated by Phillips Petroleum Co. at its Borger, Texas refinery for about two years.

TYPICAL of the thermal process are the relatively high temperatures and pressures employed. The average patent, since its purpose usually is to cover as wide a field as possible, gives rather extended ranges for temperatures and pressures under which the process may be operated. It is noted in the patents not involving catalysts that pressures up to 5000 pounds per square inch are included, the majority claiming 1000-3000 pounds. Temperatures as high as 1200 C. are mentioned, with the larger number of patents claiming between about 500 C. and 900 C. (932 F. to 1652 F.) Under such temperatures and pressures, the mechanical problems of thermal polymerization approach those of hydrogenation judging from the patent claims alone. It is understood, however, that in most cases commercial plants operating on these principles have employed temperatures and pressures nearer the lower than the higher limits outlined in the patents.

The German technologists have given particular attention to catalytic process patents, as is to be expected of a group of chemists famous for their painstaking investigation of the entire field of catalysis. Processes employing catalysts use much lower temperatures, of the order of 100-200 C., (212 to 392 F.), and pressures are also much lower than the thermal process, being 100-300 pounds as a rule.

The number of different catalysts mentioned is not great, in these patents. These catalysts include coke, refractories, aluminum, iron, silicon and boron; chromium, molybdenum, tungsten, tin, zinc, lead, nickel, vanadium, uranium, cobalt and copper, magnesium, sodium - potassium, selenium, mercury, cadmium, carbon, manganese, either metallic or as oxides, halides, etc. Acids, ketones, and aldehydes are also mentioned, phosphoric acid being the catalyst employed in the Universal process.

It is a reasonable assumption that, while this list includes most or all of the fundamental patents dealing with polymerization of gases, many of those to follow, now in the Patent Office as applications, will prove of importance especially commercially, in controlling the practical and mechanical aspects of the field. It is quite possible that an entirely new idea in polymerization may be brought out within the next year or two.

The importance of polymerization to the refining and natural gas industries can hardly be overestimated, although it requires either great temerity or great ignorance in the prognosticator who would offer a definite and detailed prediction of what is to follow, or what the relative position of polymerization will be in a few years in the list of refining processes. In this list of patents, those deal-

ing with polymerization of gases to produce rubber-like compounds, resins, heavy oils, and products other than those which are either in the motor fuel boiling range or may be used to produce such hydrocarbons have been omitted for obvious reasons. A large number of patents for producing rubber materials and resins especially, from hydrocarbons have been issued, which is a field which is out of place in this discussion.

As in cracking heavy oils, recycling is an important factor in polymerization. Recycling is mentioned in at least seven of these patents listed; U. S. P. Nos. 1,800,586, and 1,976,469, to Youker; 1,923,289 to Weber and McAdams, and 2,009,119 to Nelson; and 1,940,227, 1,941,577, 1,947,306 to Plummer. It is reasonable to assume that in raising the yields of motor fuel to the highest practicable point, this principle will prove to be one of the governing factors, when polymerization has been commercially perfected.

The present situation regarding polymerization patents is very similar in many respects to that existing in the cracking field a few years ago. Each of the several companies which has built a patent structure on this subject has a greater or less number of "swapping horses," some of which appear to be distinctly fundamental, from our present knowledge of the principles involved. Many are, as is the bulk of all process patents, merely improvements desirable and useful no doubt, but covering no fundamental principle of operation. Neither have any patents been adjudicated in court, so that no final decision can yet be made as to the relative importance of individual patents or principles.

With the recent history of cracking patents and patent litigation before us, however, it is not to be expected that the same procedure will be followed in evaluating polymerization patents, with its huge expenditures of time, effort and money which has proved so profitless to the industry as a whole. Rather may we expect a peaceable settlement of such controversies as may arise unavoidably in the development of this new field.

U. S. Patents

Number	Subject: Inventor—Assignee	Date of Issue	Claims—Purpose
1,411,255	Low-boiling hydrocarbons; C. M. Alexander, Gulf Ref. Co.	4-4-22	Heat HC gases at 500-1000 C. and heavy pressure. Re-cycling.
1,678,078	Treating light hydrocarbons to form olefins; A. S. Ramage; Bostaph Eng. Co.		Natural gas heated to about 550 C., with reducible oxide, as Fe_2O_3, to form olefins.
1,713,236	Polymerization of dienes; Midgley- Hochwalt-Thomas; General Motors Corp.	5-14-29	Treat such dienes with metal alloy catalyst which is liquid at polymerizing ; temperature e.g., Na-K, m.p. —12 C.
1,745,028	Liquid hydrocarbons from olefins; E. Ricard; Soc. Ricard, Allenet. & Cie.	1-28-30	Condense olefins with $AlCl_3$, suspended in a "petroleum derivative."
1,777,894	Benzol, etc., from ethane, propane, butane; Frank Porter; Continental Oil Co.	10-7-30	Heat HC gases at 800-950 C. over a heated nonferrous surface.
1,800,586 Reissue 19,500	Liquid hydrocarbons from natural gases; M. P. Youker; Phillips Pet. Co.	4-14-31 3-12-35	Gas fed through heating zone at above 500 lbs. and 400 °C., separated into three fractions, and recycle intermediate fraction.
1,843,880	Gasoline from gaseous hydrocarbons; W. K. Lewis-W. C. Asbury; Stand. Oil Dev. Co.	2-2-32	Heat unsaturated HCs at 300-600 C. and 600 lbs.; also at above 2000 lbs., also using contact material, a metal; also in presence of hydrogen, at 1000-3500 lbs.
1,847,095	Catalytic polymerization of hydrocarbons; Mittasch-Wietzel - Pfaundler; I. G. Farbenindustrie.	3-1-32	Mixing hydride of B, As, Bi, P, Se, Si, Sb, with gases at elevated temperatures.
1,847,238 1,847,239 1,847,240	Polymerizing hydrocarbons into liquids; F. E. Frey; Phillips Pet. Co.	3-1-32	Heat gases at 950-1500 F. then at 1250-1750 F., then chill with diluent cold gas; or with heavy oil; '240 uses 2000 lbs. pressure or less, to 500 lbs.
1,847,241 1,847,242	Conversion of gaseous hydrocarbons; L. S. Gregory-J. A. Guyer; Phillips Pet. Co.	3-1-32	Pass HCs through chamber at 1250-1750 F., for a time T, determined by formula $T = 1245 - 180 \log_{10} t$. '242 mingles heated gases in chamber with products of combustion.
1,847,257 1,847,258 1,847,259	Conversion of hydrocarbons—cracking gases; G. G. Oberfell-F. E. Frey-J. A. Guyer; Phillips Pet. Co.	3-1-32	Heat H6s in restricted zone then pass to enlarged zone, under conditions shown in 1,847,242; '258 and '259 do not mention formula for heating time.
1,851,726	Liquid hydrocarbon production; Pier-Pungs-Wietzel; I. G. Farbenindustrie.	3-29-32	Methane - ethane - olefine mixtures heated to 500-900° C. with compounds of Mg and/or Gl to produce HC of benzene series.
1,863,212	Liquid hydrocarbon manufacture; Karl Winkler; I. G. Farbenindustrie.	6-14-32	Natural gas heated at 500-900° C. and 50-150 atmospheres with active silica or oxide of alkaline earth metal.
1,865,206	Cracking hydrocarbons; H. L. Pelzer; Sinclair Refining Co.	6-28-32	Treats gas from cracking with H_2SO_4, separating polymers, hydrolyzing residue and distilling oxidized gasoline therefrom.
1,869,681	Liquid, from gaseous, hydrocarbons; P. K. Frolich; Stand. Oil Dev. Co.	8-2-32	Heat HCs to form unsaturates, then pass over metal oxide for removing hydrogen and polymerizing at above 300 lbs. and 500-900 C.
1,880,189	Liquid hydrocarbons from natural gas; W. O. Snelling; Gasoline Prod. Co.	9-27-32	Heat gas above 400 C., at pressure of 800-3000 lbs.
1,884,093	Liquid hydrocarbons from olefins; I. G. Farbenindustrie.	10-25-32	Heat olefins to 200-900 C., at 750 lbs., with Cu or noble metal catalyst.
1,884,163	Treating hydrocarbons; R. C. Osterstrom; Pure Oil Co.	10-25-32	Stripped olefin gases heated at 500-900 F., and "high pressure".
1,885,060	Polymerization of olefins; Hoffmann - Otto - Stegemann.	10-25-32	Polymerize olefins with BF_3 and HF or HI as catalysts.
1,894,255	Liquid hydrocarbons from olefins; Winkler-Haeuber; I. G. Farbenindustrie.	1-10-33	Olefins react at 300-800 C., in iron vessel, coated inside with Sn, Zn, Al or Cr.
1,894,661	Products from olefins; B. T. Brooks; Pet. Chem. Corp.	1-17-35	Separate butadiences and butenes from cracked gases, treat with 60-80% H_2SO_4; from undissolved gas polymers are separated for anti-knock fuel.
1,900,057	Process for treating an oil gas; A. E. Harnsberger; Pure Oil Co.	3-7-33	Incondensible cracking gases returned to cracking zone at 1300-1400° F. under several atmospheres pressure.
1,900,997	Aromatic hydrocarbons from olefins or paraffins; A. S. Ramage; M. Wiley and O. L. Smith, trustees.	3-14-33	Natural gas hydrocarbons and steam passed over masses of Fe_2O_3, and metallic Fe, of large surface, at 540 C. or higher-forms aromatic gasoline hydrocarbons.
1,904,362	Conversion of hydrocar-	4-18-33	Heat gases at superat-

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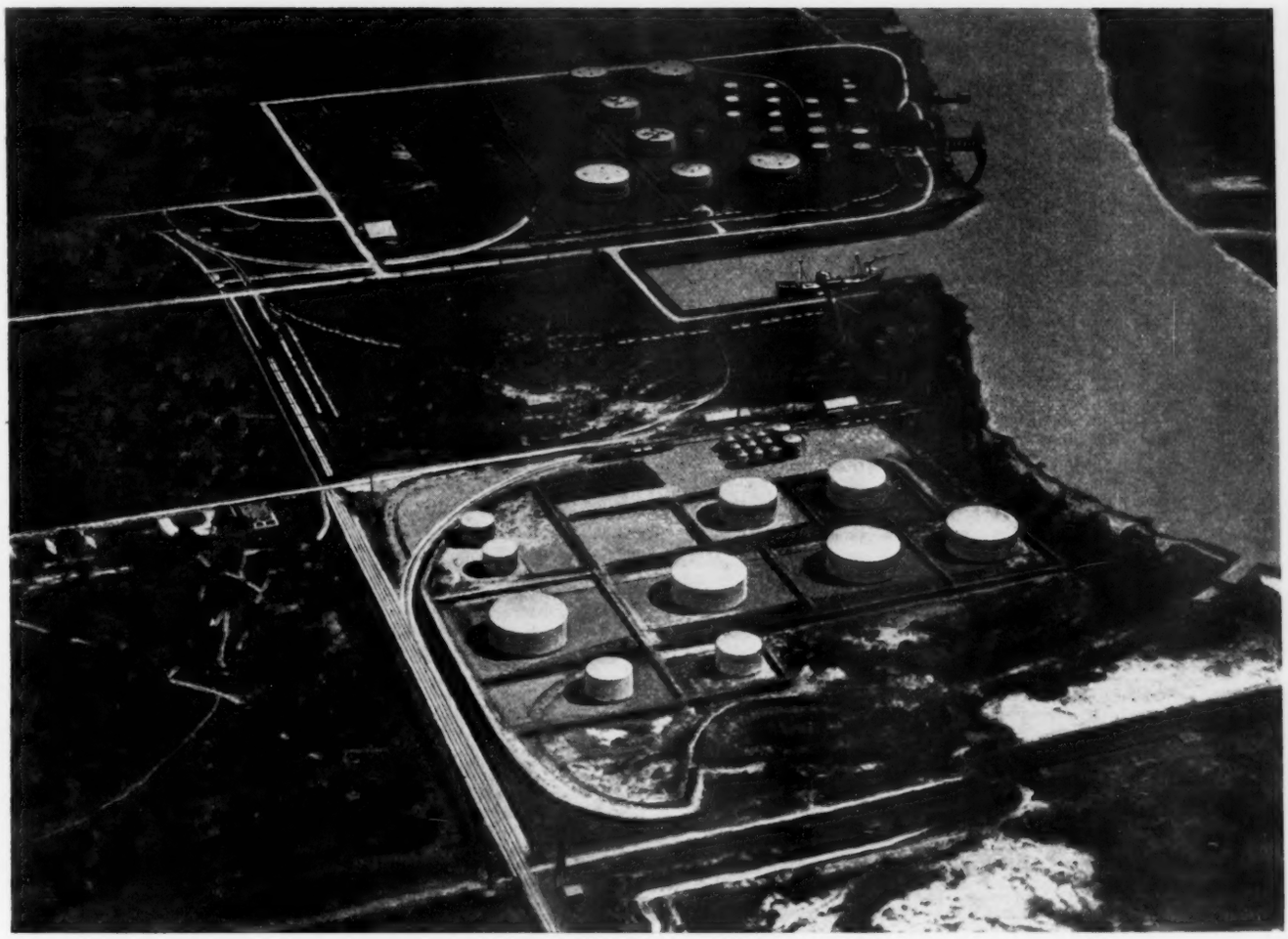

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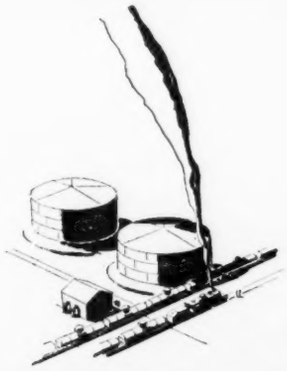

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Number	Subject: Inventor—Assignee	Date of Issue	Claims—Purpose
	bon gases; Gustav Egloff; Universal Oil Prod. Co.		mospheric pressure and 1200-1850 F., lower temperature, and expose to ultraviolet light, under vacuum.
1,905,520	Liquid hydrocarbons from methane; Steigewald; I. G. Farbenindustrie.	4-25-33	Heat CH_4 to 800-1200 C., in a vessel lined with Cr, W, Mo, or graphitic C.
1,910,910	Benzene series hydrocarbons; Wietzel and Pfaudler; I. G. Farbenindustrie.	5-23-33	Gaseous olefines converted to polymerization products at 300-500° C.; dehydrogenated with catalyst above 500° C.
1,912,009	Production of Motor fuel; E. E. Reid; Columbia Eng. and Man. Corp.	5-30-33	Heat HCs to form unsaturates, then under high pressure of above 500 lbs. to polymerize.
1,913,691	Producing gasoline; C. R. Wagner; Pure Oil Co.	6-13-33	Ethylene series gases heated to 350-700° F. at 40-100 atmospheres are contacted with metal of 8th group of periodic series.
1,918,254 1,918,255	Reforming natural gas; W. F. Faber.	7-18-33	Heat gas with air to obtain partial combustion, at 540-925 C. Apparatus for the above.
1,922,918	Production of liquid aromatic hydrocarbons; Winkler-Haeuber - Feiler; I. G. Farbenindustrie.	8-15-33	Methane heated at 700-1200° C. with metallic silicon.
1,923,289	Liquid hydrocarbon products; Weber - McAdams; Universal Oil Products Co.	8-22-33	Olefin gas heated to 425-650 C., and 100-750 lbs. At least part of unconverted gas recycled, 7-10% conversion per pass.
1,923,583	Liquid olefinic hydrocarbons.	8-22-33	Cracked gases contacted below 300 C. for 0.5 to 100 seconds with $AlCl_3$, Cu-, Co-, or Fe chlorides as catalysts.
1,933,434	Condensation of unsaturated cyclic and olefin hydrocarbons; Hoffman-Wulf; I. G. Farbenindustrie.	10-31-33	Olefins and cyclics heated at 300 C. or lower, in presence of halogen acid or boron halides.
1,933,574	Treating hydrocarbon oil; C. W. Watson; The Texas Co.	11-7-33	Cool the hot cracked gases from cracking still to polymerizing temperature without lowering pressure, hold in enlarged zone to polymerize.
1,933,845	Conversion of hydrocarbon gases; Gustav Egloff; Universal Oil Prod. Co.	11-7-33	Heat HCs to say, 1400 F., cool direct with naphtha, hold in stabilizing zone to rectify.
1,934,896	Method of producing gasoline; C. R. Wagner; Pure Oil Co.	11-14-33	Ethylene series gases passed over metallic halide ($AlCl_3$, $AlBr_3$, $FeCl_3$, $NiCl_2$, $TiCl_2$) at 350-700° F. and 600-1500 lb.
1,937,819	Non-knocking motor fuels, etc.; Winkler - Haeuber-Feiler; I. G. Farbenindustrie.	12-5-33	Dehydrogenating and polymerizing paraffins in separate chambers, where the gases come in contact with metallic silicon lining the vessels.
1,938,083	Gas treatment; Mueller-Conradi, Eisenhut, and Schilling; I. G. Farbenindustrie.	12-5-33	Acetylene recovered from gases by washing with alicyclic ketone having 3+ carbon atoms per molecule to effect dissolution.
1,938,945	Method of producing gasoline; C. R. Wagner; Pure Oil Co.	12-12-33	Ethylene series gases passed over solid absorbent (fuller's earth, activated charcoal, silica gel, etc.) at 350-700° F. and 600-1500 lb.
1,940,227	Polymerizing olefinic gases; W. B. Plummer; S. O. Indiana.	12-19-33	Heat olefins at 400-540 C., and 500-3000 lbs., cool separate light and heavy fractions, and recycle light fraction.
1,941,577	Liquid hydrocarbons from olefins; W. B. Plummer; S. O. Indiana.	1-2-34	Polymerize rich olefinic gases at 370-510 C., and 500-3000 lbs. Lean gases at 510-675 C. and same pressure. Rich and lean unpolymerized gases separated from product, and each recycled to proper heating section.
1,943,246	Pyrolysis of hydrocarbon gases; C. C. Towne; The Texas Co.	1-9-34	HC with much propane and butane heated to 650-950° C. in presence of clay type catalyst.
1,945,960	Production of hydrocarbons; Winkler and Haeuber; I. G. Farbenindustrie.	2-6-34	Olefine production from butane, propane, and ethane by heating to 360-900° C. with metal of Group 1 and free elementary silicon.
1,947,306	Polymerizing olefinic gases; W. B. Plummer; S. O. Indiana.	2-13-34	Operating conditions as in 1,940,227 and 1,941,577. Uses preheating, heating, soaking zones, and recovery system to obtain recycle gases of high and low olefin concentration.
1,960,631	Polymerizing olefins; V. N. Ipatieff; Universal Oil Products Co.	5-29-34	Polymerize olefins at 50-200 C., with H_3PO_4, or orthophosphorous acid.
1,962,107	Hydrocarbon conversion; M. P. Youker; Phillips Pet. Co.	6-5-34	Rectifies conversion vapors, at high pressure, releases pressure and separates gasoline from heavier products.
1,963,092	Treatment of hydrocarbons; F. I. L. Lawrence; Atlantic Ref. Co.	6-19-34	Heat HCs at 100-2000 lbs. and 1150-1400 F. then into reaction zone at 950-1300 F., separating into three fractions, recycle lightest fraction.
1,965,135	Liquid hydrocarbons from propane; H. H. Chesney; Union Oil Co. of Cal.	7-3-34	Heat gas to 900-925 C. in contact with "lustrous C", (graphite?), to form gasoline.
1,967,665	Hydrocarbon conversion to form aromatics; I. G. Farbenindustrie.	7-24-34	Heat gases, as CH_4, in long, unobstructed passages lined with chamotte, Si, or SiC.
1,967,269	Thermal decomposition of paraffins; H. M. Smith and H. T. Rall.	7-24-34	Crack paraffins just sufficient to cause primary decomposition; polymerize in definite temperature range; tar and light oils formed are passed over hydrogenating catalyst.
1,971,301	Hydrocarbon production; Hans Haeuber; I. G. Farbenindustrie.	8-21-34	Condense olefines from cracking paraffin oil in presence of double compound of ethylene and $AlCl_3$ at 150-160° C. Uncombined $AlCl_3$ absent.
1,971,677	Thermal treatment of hydrocarbon gases; G. H. Coxon; Gasoline Prod. Co.	8-28-34	Heat gas in restricted cross-sectional area with a "carrier gas" pass into enlarged chamber at 650-1250 C., for a given time, and rectify products.
1,971,748	Pyrolysis of hydrocarbons; F. X. Govers; Indian Ref. Co. (The Texas Co.).	8-28-34	Heat gas for short time to 1000 F., mix with CO_2-N_2 gas at 1000 F. or higher, then into molten material at 1000-1800 F.; exposed to temperature only momentarily.
1,972,926	Treatment of hydrocarbon gases; Gustav Egloff; Universal Oil Prod. Co.	9-11-34	Heat gas at about 500 lbs. and 1400-1600 F., and contact with Zn, Al, or Fe chloride catalyst, and condense.
1,976,469	Liquid hydrocarbons from hydrocarbon gases; M. P. Youker; Phillips Pet. Co.	10-9-34	Heat gases to 400-675 C. and 500-3500 lbs.; rectify to obtain light, medium and heavy fractions; light fraction liquefied and recycled along with fresh stock.
1,976,591	Utilizing natural gases; C. R. Wagner; Pure Oil Co.	10-9-34	Olefine gases from cracking natural gas polymerized at 1000 lbs. and 500-950° F.
1,976,717	Treatment of hydrocarbon gases; A. E. Dunstan-R. V. Wheeler; Gasoline Prod. Co.	10-16-34	Heat gas in elongated passage at 650-950- C., at velocity of 200-300 ft. per hour, linear, calcu-

Number	Subject: Inventor—Assignee	Date of Issue	Claims—Purpose
			lated at normal volumes at low temperatures.
1,977,659	Recovering ethylene from olefine mixtures; H. G. Watts; Imperial Chem. Ind., Ltd.	10-23-34	Wash gas mixture with ammoniacal cuprous salt solution, separate residual gases, and regenerate dissolved ethylene.
1,980,386	Manufacture of motor fuel; R. E. Burk-H. P. Lankelma; Stand. Oil Co. (Ohio).	11-13-34	Apparatus consisting of heating chamber, plurality of vertical conduits, inlet and outlet headers, and condenser.
1,981,819	Polymerization of olefins; Wiezevich - Whiteley; S. O. Dev. Co.	11-20-34	Preheat gas to 310 C., mix with enough air to cause partial oxidation, forming oxygenated polymers.
1,983,693	Polymerization of olefins; Gustav Egloff; Universal Oil Products Co.	12-11-34	Heat to elevated temperatures in contact with a phosphorus acid, as H_3PO_4.
1,986,238 1,986,239	Liquid hydrocarbons from gaseous hydrocarbons.	1-1-35	CH_4, C_2H_6, etc., heated at 400-1100 C., with 2% mercury vapor. '239 similar, but uses small per cent of cadmium vapor.
1,987,007	Liquid hydrocarbons from propane, butane; F. E. Frey; Phillips Petroleum Co.	1-8-35	Propane and butane heated above 540 C., and 1000-5000 lbs., long enough to form olefins but not long enough to form tars and heavy oils. Thence to polymerizing zone, at below 540 C. until volatile HCs form.
1,987,092	Polymerization of paraffins; I. G. Farbenindustrie.	1-8-35	Paraffins heated to above 500 C., in contact with a refractory as a silicide, silicate or phosphate of Cu, Mn, Pb or Cr.
1,988,112	Polymerization of hydrocarbon gases; Gustav Egloff; Universal Oil Products Co.	1-15-35	Heat methane, ethane, to form unsaturates, cool with CH liquid by contact; both polymerized at lower temperature than that used to form unsaturates.
1,988,479	Process for treating olefins; B. T. Brooks; Standard Alcohol Co.	1-22-35	To prevent polymerization of mono-olefines. Segregate diolefines by contacting liquid phase with fine solid Cu_2Cl_2; regenerate by heating.
1,989,425	Butylene from ethylene; Otto and Bub; I. G. Farbenindustrie.	1-29-35	Polymerize liquid ethylene by contacting with catalyst from group: $HF \cdot H_2O$ and inorganic anhydrous volatilizable metal and metalloid compounds at 30-80 atmos.
1,991,353 1,991,354	Polymerizing gaseous unsaturated hydrocarbons; W. B. Plummer; S. O. Indiana.	2-12-35	Heat gases at 420-540 C. and 1000-3000 lbs. in tubular polymerizing zone, transfer heat of polymerization to cracking charge oil to crack the latter. '354 uses plurality of steps at same pressures and 370-650 C.
1,991,593	Polymerizing refinery gases; R. E. Burk; S. O. Ohio.	2-19-35	Refinery gases contacted at elevated temperatures with zinc vapors.
1,993,503	Cracking hydrocarbon vases; Gustav Egloff; Universal Oil Prod. Co.	3-5-35	Subject gas to primary cracking temperature and low pressure, then to secondary cracking under high temperature-pressure, in presence of steam and hydrogen activated by electrical discharge.
1,993,512 1,993,513	Liquid hydrocarbons from gaseous olefins.	3-5-35	'512 heat olefins at 100-250 C. with catalyst of H_3PO_4, and alkaline earth chloride, as $MgCl_2$. '513 same, using calcined mixture of H_3PO_4 on kieselguhr.
1,994,249	Synthesis of hydrocarbons; Ipatieff and Grosse; Universal Oil Prod. Co.	3-19-35	Condense olefines from ethylene with HC of benzene series in presence of H_2SO_4; add more HC in presence of Al halide to condense ethylene.
1,994,982	Hydrogenation; R. C. Cook; Universal Oil Prod. Co.	3-19-35	Cracking gas, heated to increase H content, and residuum at hydrogenating temperature are contacted at 1000 lb.
1,995,136	Production of hydrocarbons rich in carbon; Winkler and Feiler; I. G. Farbenindustrie.	3-19-35	Heat methane series gas to convert 5% to olefines; subject to incomplete combustion above 1000° C. Acetylene is obtained.
1,995,329 1,995,330	Polymerizing hydrocarbon gases; H. M. Smith-H. T. Rall.	3-26-35	Crack and polymerize gases under heat and pressure, then hydrogenate residual gases with catalyst to form light oils. '330 also uses electrical precipitation for different products.
1,997,144 1,997,145	Benzine from gaseous hydrocarbons; Shell Dev. Co.	4-9-35	C_2H_4 polymerized in inert medium as paraffin oil, without catalyst, at 20-50 atmospheres and 300-500 C.
2,000,964	Polymerization of olefins; S. Lenher; E. I. duPont de N. Co.	5-14-35	Making propylene, and homologues from ethylene and propylene; heat a mono-olefin of less than 10 C. atoms at 400-700 C., with O_2 concentration of 0.5 to 5% of olefin.
2,001,906-910	Anti-knock motor fuel; V. N. Ipatieff; Universal Oil Prod. Co.	5-21-35	Distillate containing straight run gasoline, and olefin gases from cracking still treated with H_2SO_4 to alkylate the olefins by the distillate. Also use sludge acid as reagent.
2,002,394	Higher boiling hydrocarbons from ethylene, propylene, butane, etc.; F. E. Frey; Phillips Pet. Co.	5-21-35	Saturated HCs kept at 470 C. and 3000 lbs., mixed with small amounts of olefins successively (5-10% at a time), and whole reaction mixture fractionated.
2,002,534	Higher boiling hydrocarbons from gases; Per K. Frolich; Stand. Dev. Co.	5-28-35	Saturated HCs cracked to olefins and C_2; mixed with gas rich in C oxides. H_2 reacts with O of oxides, and gas is polymerized at high temp.-press.
2,002,524 2,002,525	Heat treatment of hydrocarbons; Cambron-Bayley.	5-28-35	'524. Saturated HCs heated at 700 C. flowing through narrow space, with baffles at certain points. '525. Apparatus for above.
2,005,861	Alkylated hydrocarbons; V. N. Ipatieff; Universal Oil Prod. Co.	6-25-35	Treat benzene or its homologues with gaseous olefins in presence of H_3PO_4 at 60 C.
2,006,078	Catalytic converter; E. Pyzel; Shell Dev. Co.	6-25-35	Converter shell containing alternate layers of coarse and fine catalyst of same composition arranged transverse to gas flow.
2,007,159 2,007,160	Polymerizing gases with sulfuric acid; W. Engs-R. Moravec; Shell Dev. Co.	7-9-35	Treat olefins in liquid phase with 70% H_2SO_4, heat to form polymers from chiefly tertiary olefins, treat acid liquor with more olefins.
2,007,754	Benzene hydrocarbons from olefins; Feiler-Haeuber; I. G. Farbenindustrie.	7-9-35	Heat olefins at 400-1300 C. in presence of coke from dry distillation of coal.
2,008,468	Production of motor fuels; R. H. Price; S. O. Indiana.	7-16-35	Heat gases at elevated temperatures and pressures, absorb polymers in absorbent oil, strip "fat" oil with hot cracked gases to recover benzenoid CHs formed.
2,008,491	Polymerization of diolefines; Ebert and Garbsch; I. G. Farbenindustrie.	7-16-35	Contact with alkali metal and unsaturated ether having olefinic double carbon bond in molecule.
2,009,062	Minimizing polymerization; K. B. Lacy; Van	7-23-35	React H_2SO_4 partially with olefine and add a

Number	Subject: Inventor—Assignee	Date of Issue	Claims—Purpose
	Schaack Bros. Chem. Works, Inc.		primary alcohol to satisfy remaining reactivity of acid.
2,009,119	Motor fuel from casinghead gasoline; E. F. Nelson; Universal Oil Prod. Co.	7-23-35	Heat natural gasoline to temperature which raises anti-knock value; products are fractionated, and intermediate fraction returned for reheating, with raw charge.
2,009,879	Treating cracked hydrocarbon vapors; Gustav Egloff; Universal Oil Prod. Co.	7-30-35	Contact hot vapors with $ZnCl_2$ in water solution in presence of hydrogen, to absorb vapors and saturates the unsaturates, and condensing HCs.
2,009,902	Polymerizing hydrocarbons; R. C. Osterstrom; Pure Oil Co.	7-30-35	Pass cracked distillates through polymerizing zone with an agent composed of polymers treated with H_2SO_4, heat to vaporize distillates under super-atmospheric pressures, separate low boiling oils, and treat high boiling oils with H_2SO_4.
2,010,948 2,010,949	Alkylating aromatic hydrocarbons; Gustav Egloff; Universal Oil Prod. Co.	8-13-35	Separate alkylated HCs, which are heavier than motor fuel, from reaction mixture, and return to reaction zone for dealkylating, as with $AlCl_3$ or $ZnCl_2$.
2,010,982	Cracking and hydrogenation; C. P. Dubbs; Universal Oil Prod. Co.	8-13-35	Hydrogenating cracked gases; contacting cracked distillate with cracked gas to saturate distillate, heating gases before entering either zone to temperatures which increase hydrogen content of gases.
2,011,385	Pyrolysis of gaseous hydrocarbons; C. C. Towne; The Texas Co.	8-13-35	Paraffins heated to conversion temperature of 650-950 C., passed to enlarged reaction zone without further heating, in contact with catalyst, as selenium vapors.
2,014,724	Manufacture of olefins; D. B. Eastman; The Texas Co.	9-17-35	Isolate paraffins from refinery gases into fractions each containing essentially the same number of C atoms per molecule, cracking to olefins under optimum conditions.
2,017,325	Polymerization of gases; R. F. Ruthruff; S. O. Indiana.	10-15-35	Separate liquids from unreacted gases from cracking in stages at progressively lower pressures. Separate fixed gases and eliminate; separate olefinic gas and recycle to polymerizing step; eliminate saturated gases. Temp. — 750-1000° F.; pressure—500-3000 lbs.

French Patents on Polymerization (16)

Number	Subject: Inventor—Assignee	Date of Issue	Claims—Purpose
592,474	Thermal decomposition of gaseous hydrocarbons; I. Szarvasy.	7-13-26	Heating HCs, in chamber with holes blocked with porous carbon, or other medium for gases to pass through.
632,768	Polymerization of olefins; F. Hoffmann-M. Otto.	4-14-27	Olefins polymerized in presence of BF_3, under pressure, with or without finely divided metals.
640,534	Polymerization of hydrocarbons; V. Szidon.	2-18-27	Forms pasty polymerization products under heat and pressure, with catalyst metals, as oxides, or organic or inorganic acids, etc.
680,038	Polymerization of hydrocarbon gases; Pure Oil Co.	8-7-29	Olefins heated to 260-540 C., and 90-265 lbs. pressure, in presence of Aluminum halides.
688,450	Polymerization of unsaturated hydrocarbons; I. G. Farbenindustrie.	1-18-30	Uses electrical wave discharges or emanation.
690,935	Products from ethylene; N. V. Bataafsche Pet. Maat.	2-26-30	Ethylene polymerized in an inert liquid carrier, such as Edeleanu extract.
707,232	Polymerization of paraffins; I. G. Farbenindustrie.	12-8-30	Saturated hydrocarbons heated in presence of coke.
709,591	Polymerization of methane; I. G. Farbenindustrie.	1-17-31	Heat CH_4 to 960-1200 C., with metallic silicon- forms aromatics.
707,841 see also Br. 349,444	Treatment of hydrocarbons; R. H. Griffith; Gas Light and Coke Co.	12-15-30	Uses titanium, tungsten or chromium as catalysts; silicon and boron as "promoters" — both made into a paste and dried.
711,331	Liquid hydrocarbons; I. G. Farbenindustrie.	2-16-31	Heat CH_4 with Cr, Mo, or W as catalysts, or in alloy vessels containing these metals.
711,394	Hydrocarbons; I. G. Farbenindustrie.	2-17-31	C_6H_6, etc. formed by heating CH_4 and other HCs. by passing through canals in coke oven walls.
730,385	Anglo-Persian Oil Co.	1-23-32	Pass HCs. through heated tubes, to large soaking vessel, then to small vessel, then to small vessels to chill suddenly.
750,869	Heat treatment of hydrocarbons; I. G. Farbenindustrie.	8-21-33	Olefins polymerized by heating in vessels lined with a catalyst of Cr, Mo, Fe, Pb, made by decomposing volatile salts of the metals.
759,718	Polymerization of olefins; Standard Oil Co.	2-7-34	Olefins concentrated by fractionation; with 50% olefins in gas, heat to 370-510 C. & 300-3000 lbs.; higher temperature-pressure for lower concentrations.
771,272	Hydrocarbon polymers; S. O. Dev. Co.	10-4-34	Treat heated gases with unnamed polymerizing agent.
44,501	Hydrocarbons; I. G. Farbenindustrie.	2-19-35	Polymerizing isobutylene in contact with $AlCl_3$ at 50 C. or lower, or with halides of elements in groups 2, 5, 6, and 8. Forms heavy hydrocarbons.

British Patents (25)

Number	Subject: Inventor—Assignee	Date of Issue	Claims—Purpose
261,267 271,767	Polymerizing methane; A. Folliet; Petrole Synthetique Soc. Anon.	4-29-26 1-1-27	Heat CH_4 uniformly, cool suddenly; heat to 950 C. 20 mm. Hg absolute pressure.
258,608	Liquid hydrocarbons from methane; I. G. Farbenindustrie.	9-17-25	Heat CH_4 at 600-900 C., 50-1000 lbs. over active SiO_2, C. or Mg, Se, or Tellurium oxides.
295,705	Polymerization of C_2H_4 to liquid hydrocarbons; C. Epner.	8-18-27	Form lubricating and gasoline Mcs. by silent electric discharge, with or without catalysts.
309,199	Liquid-hydrocarbons from olefins; I. G. Farbenindustrie.	9-28-27	Olefins heated with catalysts, as Fe coated with Sn, Zn, Al, Cr, under pressure at 750-800 C.
309,488	Hydrocarbons and free carbon from natural gas; G. C. Lewis.	4-11-28	Heat methane, ethane of natural gas to 600-900 C., at 5-10 inches water pressure, to form cyclic Hcs.
309,455 327,715	Aromatic hydrocarbons, from cracked gases.	10-8-27 10-5-28	Gas heated below 550 C., then into reaction tubes at 650-750 C., for C_3H_{12},

Number	Subject: Inventor—Assignee	Date of Issue	Claims—Purpose
			to 850-975 C. for CH_4. May add superheated steam.
313,067	Polymerizing olefins; Hoffmann - Otto - Stegemann.	3-5-28	Olefins heated with BF_3 and water, hydrohalogen acid, or alkyl halide.
315,895	Olefins from heavy tars; I. G. Farbenindustrie.	3-16-28	Heat tars, oils, etc., with or without Fe, Ni, or Cr catalysts, and with water vapor. Obtains 90% olefins.
331,186	Polymerizing olefins; Bataafsche Pet. Maat.	3-18-29	Heat olefin in inert liquid without catalysts. E.g., C_2H_4 heated to 420 C. and 675 lbs., in paraffin.
335,353 (see U.S. 1,812,372)	Aromatic hydrocarbons; A. S. Ramage.	9-3-29	Heat olefins with CO and H_2 in presence of metallic Fe, at atmospheric pressure and 450-815 C.
342,319 and 342,359	Pyrolysis of hydrocarbons; Wheeler-McAulay-Francis; Imperial Chem. Ind. Ltd.	8-21-29 8-21-29	319 is a one-step, 359 is multiple stage process. Heat olefins to 1000-1200 C., space velocity of 1/50 to 1/100 minute.
341,391	Polymerizing hydrocarbon gases; C. R. Wagner.	7-8-29	Unsaturated gases heated at 425-540 C., and 300-1000 lbs., condensed at same pressure, return very light HCs to reaction zone.
355,210	Polymerization of CH_4, C_2H_4, C_2H_2; Ruhr-chemie, A. G.	2-16-30	Treat gases with high frequency electric oscillations, at above 900 C.
361,944	Low boiling hydrocarbons; I. G. Farbenindustrie.	7-25-30	Heat paraffins, olefins, to 500-950 C., in two stages.
366,107	Hydrocarbons; I. G. Farbenindustrie.	9-26-30	Ceramics lining of polymerization reaction vessel is coated with oxides of Cr, W, V, or U, to prevent carbon deposition.
373,600	Apparatus; I. G. Farbenindustrie.	1-24-31	Gas heater filled with two or more of the following materials—SiC, Zr, or magnesite—arranged in zones.
372,321	Olefins; I. G. Farbenindustrie.	5-2-32	Contact olefins with inorganic anhydrous halides, as $AlCl_3$, $CoCl_2$, $CuCl_2$, $FeCl_3$, at 300 C., for 0.5 to 100 seconds.
392,643 392,644	Decomposing hydrocarbons.	5-25-33	Form olefins by heating gas passing through converter containing a refractory previously heated.
406,326	Cracking and polymerizing hydrocarbons; Texaco Dev. Co.	2-12-34	Preheat natural or refinery gas to 550 C., heat in first zone to 650-950 C., mix with gasoline or naphtha in soaking zone held at 600-900 C., to form high anti-knock gasoline.
412,933	Polymerizing gases; C. J. Greenstreet.	6-28-34	Heat gas to 600-1200 with catalyst—Cu or Cr—with extended contact surface.
415,792	Hydrocarbons; M. P. Appleby; Imperial Chem. Ind. Ltd.	9-3-34	CH_4 is polymerized with a napthene-rich liquid hydrocarbon, or gas, to form motor fuel in presence of heavy metal oxide, as Mo oxide.

German Patents (12)

Number	Subject Inventor—Assignee	Date of Issue	Claims—Purpose
524,891	Polymerizing olefins; Hoffmann-Stegemann.	5-23-28	Uses HF as catalyst, at ordinary or raised pressures and temperatures.
505,265 512,959	Olefin polymerized products; Hoffmann-Otto.	4-24-26 2-5-27	Heat olefins with BF_3, also with finely divided Ni or other metals.
564,404	Aromatic hydrocarbons; I. G. Farbenindustrie.	9-18-25	Heat gas to 600 C. and 2250 lbs., with catalysts shown in Ger. Pats. 509,406; 545,164; 547,080, or with active C.
535,726 565,159	Olefins and diolefins; I. G. Farbenindustrie.	11-29-27	Cyclic or non-cyclic paraffins and/or olefins passed over anthracite and MgO bed, at 700 C. Yields 80% olefins, 12% butadienes.
576,141	Polymerizing olefins; Pummerer-Kehlen.	5-8-33	Polymerize olefins by irradiation with visible or ultra-violet rays in presence of aldehyde or ketone.
573,532	Benzine from ethylene; Bataafsche Pet. Maats.	4-1-33	Heat olefins in inert liquid as paraffin oil under pressure without catalyst, to produce HCs boiling between 100-200 C.
504,730 507,919	Polymerizing olefins; Hoffmann - Otto - Stegemann.	3-24-33 4-28-33	Heat olefins with BF_3 and hydrogen halides, (except HF), at pressures up to 2000 lbs.
583,685	Olefins; I. G. Farbenindustrie.	9-7-33	Sulfur-containing olefins heated with silicon catalyst. C_2H_4 gives 74% of benzene and toluene.
615,447	Hydrocarbons; F. Waechter.	7-4-35	Gaseous hydrocarbons exposed to glow discharge, and heated to above 900 C. to form benzene.

Canadian Patents

Number	Subject: Inventor—Assignee	Date of Issue	Claims—Purpose
338,207	Separation of Olefins; Shell Dev. Co.	12-26-33	Treat olefins with 60-70% H_2SO_4, at minus 25 C., to form alkyl sulfates; sulfates are heated, and polymerized products in motor fuel range are separated.
341,531	Conversion of hydrocarbons; W. B. Plummer; S. O. Indiana.	5-8-34	Gas rich in olefins polymerized at low temperature, high pressure, lean olefinic gas at high temperature and pressure. Light fraction from reaction products separated in plural stages. Recovered olefins are recycled.
342,155	Pyrolysis of hydrocarbons; M. Halpern, et al; Texaco Dev. Co.	6-5-34	Heat gas to produce unsaturates, polymerize at 300-600 C., and 200-5000 lbs., in presence of acid-treated clay.
342,496	Pyrolysis of hydrocarbons; C. C. Towne; Texaco Dev. Co.	6-19-34	Crack paraffin gases at 650-950 C. to form 50% of olefins. Heat at 450-500 C. and above 1500 lbs. with absorptive-clay type of catalyst.
348,354	Conversion of paraffin gases; L. G. Story; Texaco Dev. Co.	2-19-35	Gaseous paraffins heated in elongated passage to 650-950 C.; passed to second zone, heated to 600-900 C. complete conversion to motor fuel.

3.5 Cents Per Gallon is Manufacturing Cost of Polymerized Gasoline

By P. C. Keith, Jr.* and J. T. Ward*

IN THE United States there are in operation well over 25,000,000 automotive engines which consume approximately 1,260,000 bbl. of gasoline per day. While there is an obvious connection between the properties of the gasoline, the design of the motor, and the cost of operation, the economics of the situation have not thus far given impetus to great changes in either gasoline characteristics or motor design — with certain few exceptions. Moreover, while co-operation exists between refiners and motor manufacturers to effect concordant improvements in motors and fuel, progress has not been rapid. The processes presently employed in the manufacture of gasoline, cracking, and distillation — while adequately meeting the present requirements — are for the most part carried out with little control over the type and content of the specific compounds constituting the final product.

However, impelled both by the desire to increase product sales and by scientific incentive, petroleum technologists have been actively developing new types of motor fuels possessing properties that are intriguing and attractive to the automotive designer, the motor fuel manufacturer, and the motorist alike. These developments naturally incur the use of different processes and, in certain cases, new raw materials. Refiners have long desired to employ, in the manufacture of motor fuels, the normally-gaseous refinery residues as well as natural gas, which is available in such great quantities. It was obvious that the successful utilization of natural gas for this purpose would open up a vast field in which the raw stock was both abundant and cheap; the use of refinery gas was attractive because of the natural desire to enhance the value of this invariable and undesirable result of cracking.

(Presented before 16th Annual Meeting, American Petroleum Institute, Nov. 11-14, 1935, under the title "The Thermal Conversion of Hydrocarbon Gases to Gasoline.")

Research on Hydrocarbon Transformations

Research on both these types of gases indicated, first, the possibility of producing from them — substantially by controlled chemical synthesis — motor fuels whose performance characteristics lay entirely outside of those which would normally result when manufacturing gasoline by conventional refinery processes. A second result of this work was the appreciation that these new fuels had potential possibilities in modifying, and probably accelerating, the evolution in automotive-engine design that gradually is taking place with resultant improvement in efficiency and performance.

For practically two decades the technical and patent literature on refining has been replete with references bearing on this general subject of converting hydrocarbon gases to liquids. The published data on the decomposition and polymerization of the olefinic hydrocarbons up to 1930 has been admirably summarized by Egloff, Schaad, and Lowry.[105] The more important data published on the pyrolysis and polymerization of low-molecular-weight hydrocarbons have been reviewed by the writers in the course of a general literature search on this subject, and a list of references is appended.

A mental picture of all these data inclines one to classify the principal processing methods reported into five general groups. These are:

1. *High-temperature, low-pressure gas cracking into unsaturates.* When such a process is carried out primarily for the manufacturer of motor fuel, the cracking obviously must be followed by polymerization.

Typical of this work has been that of Cambron and Bayley,[10, 11] Dunstan et al., [13, 14, 15] Frey et al.,[21, 22, 23] Frolich et al., [24, 25, 26] Hurd et al.,[32, 33, 34] Neuhaus et al., [51, 52] Pease et al.,[58, 59, 60] Rice,[65] Sullivan.[73]

2. *High-temperature, low-pressure pyrolysis of saturates and unsaturates primarily to produce aromatics.* Typical of these methods is the work of Cambron and Bayley,[90, 91] Dunstan et al.,[97, 98, 99, 100, 101, 102] Frey et al.,[109, 110] Podbielniak,[143, 144] Zanetti.[167, 168, 169]

3. *Non-catalytic polymerization of gaseous olefins,* as reported by Dunstan,[176, 177, 178, 179] Ipatieff,[180, 190] Sullivan,[207] Wagner.[210]

4. *Catalytic polymerization of gaseous olefins,* as investigated by Gayer,[214] Ipatieff et al.,[217, 218, 219, 220, 221, 222, 223, 224, 225] Waterman.[244, 245, 246, 247]

5. *Methods such as alkylation for affecting the combination of saturates and unsaturates,* as shown by the work of Ipatieff et al.

It is apparent that research on the first four general groups has been characterized by: *a*, the assumption that the saturated compounds are so chemically inert that some degree of unsaturation must be effected before the components can be

*The M. W. Kellogg Co., Jersey City, N. J.

processed effectively; *b*, the placing of emphasis on the so-called once-through operations (work recently reported by Wagner is a distinct exception to this); and, *c*, the importance given to the production of aromatic compounds.

The reactions in the fifth group differ from those of the other classifications in that: 1, it is indicated that under certain conditions the supposed chemical inertness of saturated compounds may be overcome and they may be made to act directly; and, 2, emphasis is shifted, to a considerable extent, from the production of aromatic compounds to that of aliphatics and relatively stable olefins — although such a process may be operated to produce aromatics at a sacrifice of other characteristics. However, most of the data reviewed refer to once-through operations — although Tropsch, Wagner, and others have pointed out that increased yields may be expected from a re-cycling operation.

Development of the Unitary Process

This analysis of the data disclosed little published material descriptive of one very interesting field, viz., a unitary non-catalytic process for the production of motor fuels from either natural or refinery gases. The present discussion deals with certain results of cooperative effort on hydrocarbon transformations from which such a distinctive process for the manufacture of motor fuels possessing valuable properties has been evolved. These data do not infer that, depending on the constitution of the feed stock, certain other combinations involving multi-coil operation may not be desirable. One such possibility could consist of a two-stage process in which the charge would be first subjected to polymerization conditions, followed by separation of liquids — and a second step, consisting of substantially a unitary process for converting the residue. Another alternative would be, of course, low-pressure, high-temperature cracking of the feed, followed by high-pressure polymerization, with separation of liquids, succeeded by a unitary process. Other combinations may be used as required, but it is believed that in a majority of cases the unitary operation will show a preferred economic advantage.

Several years ago experimental data, as yet unpublished, on the reaction rates of the pyrolysis of mixtures of hydrocarbons, obtained in the laboratories of certain of the companies now in the Polymerization Process Co. group, suggested a method of attack, generally different from those that had been proposed, in which the raw charging stock was to be treated as a liquid, rather than gas, and processed specifically in the highly-condensed phase.

The factual basis for this entire development rests, aside from authentic published data, on the following:

A. Single-pass runs at pressures varying from atmospheric to 4500 lb. per sq. in.

B. Re-cycling pilot-plant operations over the complete pressure and temperature range permitted by available materials of construction.

C. Full-scale commercial operation at the Alamo refinery of the Phillips Petroleum Co. at Borger, Tex.

D. The use of feed stocks in the above operations varying from pure ethane, propane, and butane (and mixtures thereof) to the complex mixtures found in stabilizer reflux and absorber-oil distillates.

Aside from leading to the inference that a unitary process

Table 1

Re-cycling Operation

Run No.	772	861	903	942
Pressure, lb. per sq. in.	800	1200	1200	1200
Temperature, °F.	1000	1000	1100	1030
"Net" yield, per cent by weight	67.9	69.0	69.6	64.5
Weight, per cent of saturates in feed (net)	57.0	54.0	60.7	59.9
Weight, per cent of unsaturates in feed (net)	43.0	46.0	39.3	40.1
Net yield as per cent of unsaturates in fresh feed	158	150	177	161
Gallons of liquid per 1000 cu. ft. net gaseous feed	12.78	13.10	14.40	13.5
Gross feed, per cent by volume:				
C_2H_4	3.4	1.9	2.4	2.0
C_2H_6	12.2	6.8	9.6	6.5
C_3H_6	29.6	30.5	21.3	21.0
C_3H_8	46.3	49.8	38.8	39.6
C_4H_8	4.3	4.8	11.0	13.6
C_4H_{10}	4.2	6.2	16.9	17.3
Net feed, per cent by weight:				
C_3H_6	43.0	41.1	23.1	20.3
C_3H_8	57.0	54.0	36.4	37.1
C_4H_8	.....	4.9	16.1	19.8
C_4H_{10}	.....	.....	24.3	22.8
Blending value of 400-EP distillate, 50 per cent in "A" reference fuel, octane number C. F. R. M.	92	90	83	88

Table 2

Once Through Operation

1. Run no.	1217-1	1217-2	1217-3
2. Pressure #/sq. in. Ga.	800	800	800
3. Temperature, ° F.	800	800	850
4. Charge, grams per hour	667	635	1327
5. Products			
(a) Liquid, grams per hr.*	213	211	546
(b) Gas, grams per hr.	454	424	781
6. Unsaturates Converted, grams per hr.†	148	155	307
7. Liquid required from Saturates, grams per hr.	65	56	239
8. Potential liquid from Saturates if Converted to Unsaturates, gr. per hr.	55	46	197
9. Gas Analyses, grams per hr.			

	Charge	Product	Charge	Product	Charge	Product
H_2	..	2	..	1	..	2
CH_4	1	6	1	5	2	12
C_2H_4	5	5	4	3	9	4
C_2H_6	19	14	18	17	37	13
C_3H_6	155	92	148	79	309	123
C_3H_8	170	120	162	113	339	161
C_4H_8	172	109	163	109	342	228
C_4H_{10}	85	68	81	71	169	120
C_5H_{10}	41	19	39	8	81	79
$C_5H_{12}+$	19	19	18	18	39	39

*Includes C5+ observed in the product gas which did not appear in the charge gas as such.
†100% conversion to liquids assumed.

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possessing certain of the characteristics of a conventional gas-oil cracking operation would have important advantages in gas cracking and polymerization, these data indicated the following:

a. Gas cracking is essentially an apparent first-order reaction; polymerization is distinctly a second-order effect; and both obey the conventional physico-chemical laws governing such reactions.

b. Polymerization and cracking may be effected simultaneously by proper choice of conditions.

c. The relative rates of cracking and polymerization may be so controlled that the required olefin production for re-cycling may be obtained without substantial naphtha degradation.

d. Direct conjugation of saturates with unsaturates may be effected at reasonable rates.

e. Liquid yields of over 14 gal. (net) per 1000 cu. ft. of gaseous feed (60° F. and 30 in. mercury) may be obtained with either high or low volatility and having octane-blending values varying from 80 to over 120 C. F. R. motor method.

Re-cycling Pilot-plant Results

In that portion of the development of the unitary method of hydrocarbon conversion which was carried out on a pilot-plant re-cycling basis, the range of operating variables chosen was dependent on the limits imposed both by the reactions inherent in the process and by the physical limitations imposed by the materials of construction available or most economical. During most of these runs the fractionating system of the pilot plant operated to afford imperfect separation of C_2 and C_3 constituents—and, therefore, a true re-cycling operation did not obtain. However, the off-gas stream and the cycle stock were both subjected to low-temperature analysis, and the observed yields were calculated to a "net" basis to eliminate variations due to changes in the efficiency of the gas-recovery part of the pilot plant — a translation of the results that would obviously not be necessary in the case of a

commercial unit designed for maximum operating efficiency.

Further — because in every case investigated there was a net production of hydrogen, methane, and ethylene — it has been assumed, when calculating the possible liquid production from propane and butane, that the former three compounds were not a source of gasoline. Therefore, net yield is defined as the yield realized based upon the C_3 and C_4 fractions disappearing. In another part of this paper there is presented evidence showing direct juncture of saturates with unsaturates, and the assumption is made that the C_2 compounds derived from cracking propane and butane do enter into the reactions which result in the production of liquids boiling in the gasoline range. Unquestionably this assumption is open to doubt, but the purpose of this procedure was to afford no advantage to the conclusion that saturate to unsaturate juncture had taken place.

A series of four pilot-plant re-cycling runs, on which the raw feed consisted of stabilizer reflux, are first presented as representative of typical operating results (see Table 1).

From these data it will be observed that:

1. The potential yields, whether expressed as gallons of liquid per 1000 cu. ft. of feed measured as gas (12.8-14.4 gal.) or as weight per cent on charge (64.5-69.6 per cent) are very high.

2. These yields show a conversion of upwards of 150 per cent of the unsaturates in the feed, thus indicating in the first instance concomitant polymerization of unsaturates and cracking of saturates; the later at rates which were not conventional for the temperatures employed. That some direct reaction of saturates with unsaturates undoubtedly takes place in such operations will be demonstrated hereinafter.

Moreover, these runs demonstrated the feasibility of a process which in effect may be considered an economic compromise between cracking and polymerization.

Direct Reaction of Saturated and Unsaturated Compounds

In other runs evidence of direct reaction of saturates

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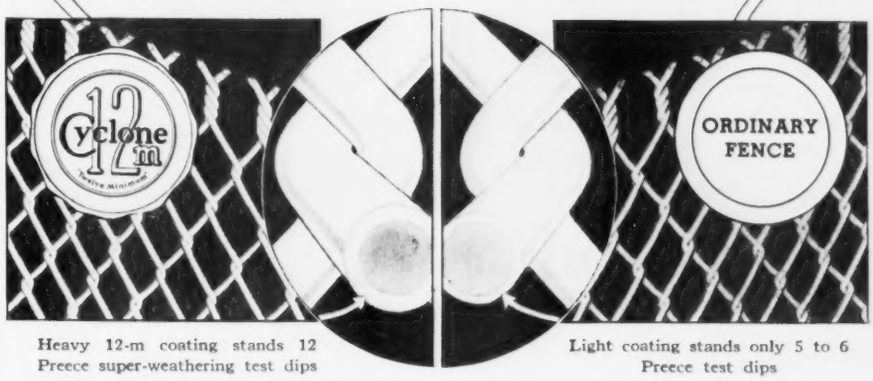

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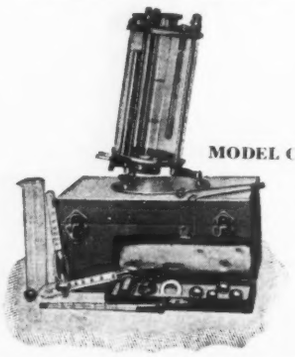

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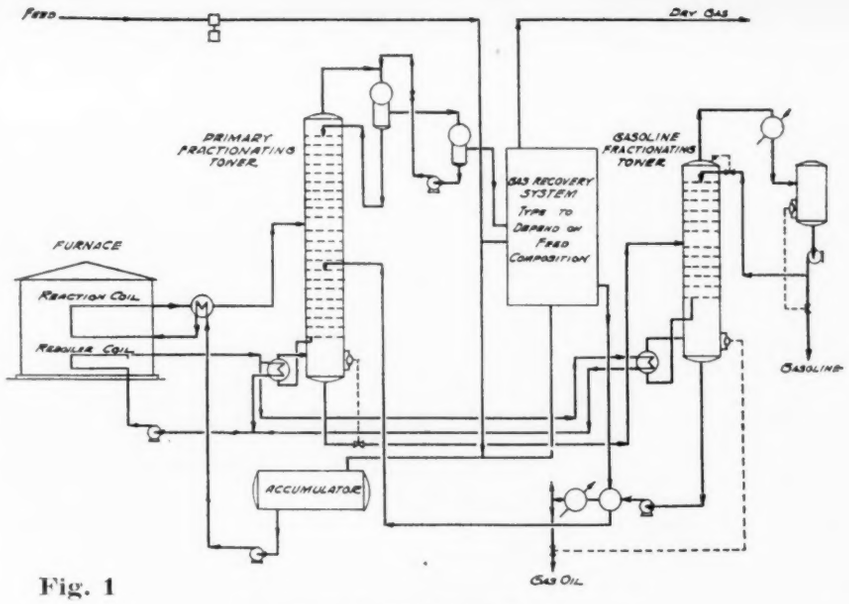

Fig. 1

DIAGRAMATIC FLOW SHEET OF POLYMERIZATION PROCESS CORP. UNIT.

with unsaturates had been obtained, and to test this deduction a series of once-through runs was made in which the temperatures were kept well below those at which cracking of saturated hydrocarbons would be material, i.e., 800 and 850° F. The charging stock consisted of condensibles which resulted from reforming a Mid-Continent heavy naphtha. These data are presented in Table 2.

Chemical analyses which will detect with certainty saturate to unsaturate juncture are presently impossible or of doubtful accuracy. We are, therefore, forced to the indirect method of observed differences. In this series the liquid product was weighed, and the gases were metered accurately. To penalize to the utmost the idea that saturates directly combined with unsaturates, the latter-named compounds in the feed stock were considered to be polymerized quantitatively to liquids (Table 2, item 6). The difference between these figures and those of item 5 (a) denotes the liquid pentane and heavier which must have come from the saturated compounds, either as such or converted to unsaturates and then polymerized. To test this — it has been assumed that when the ethane, propane, and butane disappearing are decomposed thermally to completion, the per cent by weight of unsaturates is respectively 93.4, 79.5, and 67.5. These data and the feed compositions permit the calculation of item 8, which represents the potential liquid if the saturates disappearing

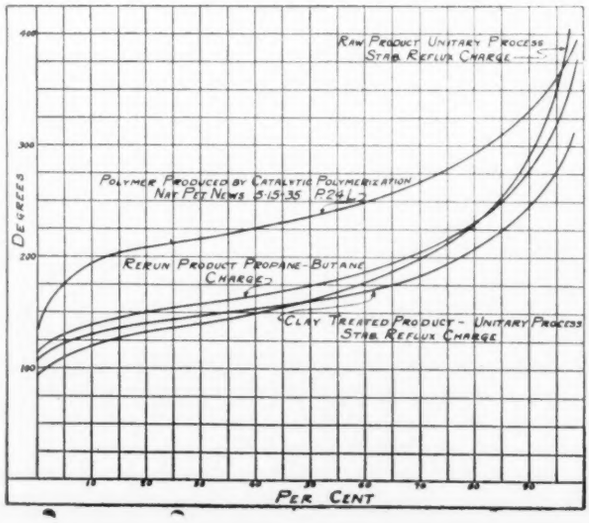
RAW PRODUCT UNITARY PROCESS STAB. REFLUX CHARGE
POLYMER PRODUCED BY CATALYTIC POLYMERIZATION NAT. PET. NEWS 5-15-35 P241
RERUN PRODUCT PROPANE-BUTANE CHARGE
CLAY TREATED PRODUCT - UNITARY PROCESS STAB. REFLUX CHARGE
DEGREES
PER CENT

Fig. 2

were converted to unsaturates and polymerized.

It will be noted that in each case the balance of the liquid required, (item 7) could not be produced by polymerization of the potential unsaturates which would be derived from the saturates, and that an appreciable amount of direct combination of saturated with unsaturated compounds must have taken place. Similar observations were made quite independently in experiments conducted in another laboratory in pyrolyzing much less complex mixtures at high pressures and at temperatures between 1000 and 1150° F.

The runs reported in Table 2 were made at 800 and 850° F., and at these temperatures one may expect only a slight thermal dissociation of the saturated hydrocarbons — an effect which would, of course, increase with temperature. A succeeding series was run, single-pass, at 1000°, 1050°, 1075° and 1100° F. during which were obtained at 1000° F. results similar to those previously discussed. This was not true at the higher temperatures and in these latter runs it is probable that the saturates were cracking at a sufficiently high rate that liquid formation occurred predominantly through the mechanism of polymerization.

That these results are not confined to operations in which the unsaturate content of the feed stock is high is shown by the results of run 961 (Table 3) in which the *net* unsaturate

Table 3

Re-cycling Operation

Run No.	961
Temperature, ° F.	1020
Pressure, lb. per sq. in.	1200

Feed, per cent by weight:

	Gross	Net
C_{2^+}	2.5	.....
C_3H_6	7.0	4.8
C_3H_8	14.4	10.8
C_4H_8	8.6	8.9
C_4H_{10}	67.5	75.5
Unsaturates, per cent by weight		15.6
Net unsaturates, per cent by weight		13.7
Net yield, per cent by weight		58.2
Net yield as per cent of unsaturates in fresh feed		425
Net gallons of liquid per 1000 cu. ft. net gaseous feed		14.29
Per cent saturates converted to polymer		55.0

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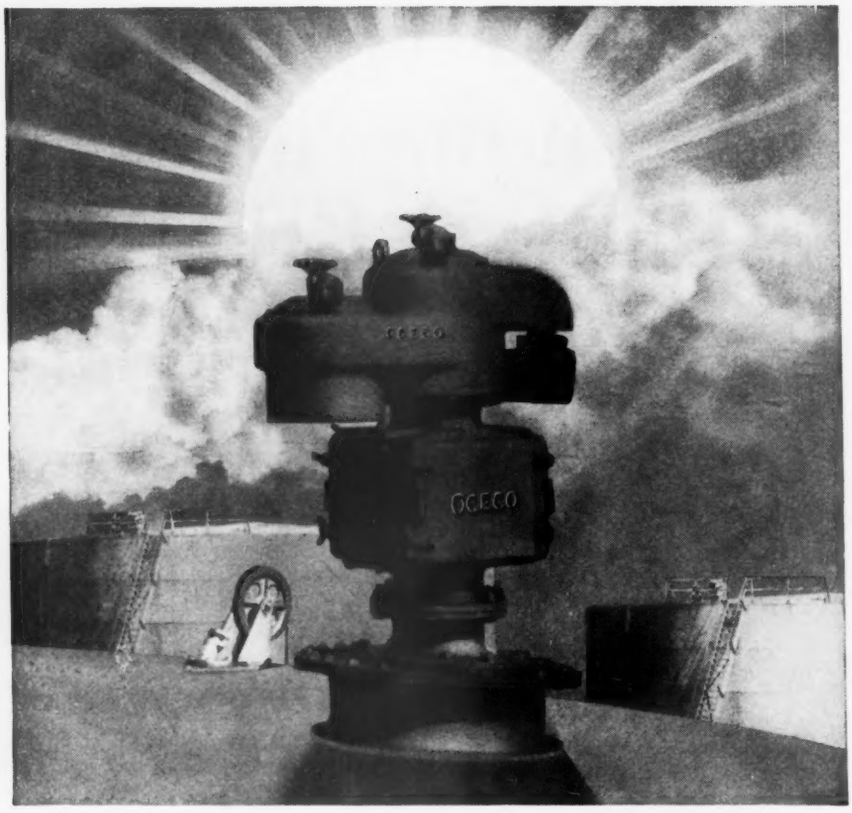

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content of the charge stock was 13.7 per cent.

It will be observed that, as in previous runs, we obtained a liquid yield much in excess of that which would correspond to the unsaturate content of the feed stock — here 425 per cent. Obviously, all of the liquid could have been formed from unsaturates produced from saturates, but the character of the naphtha indicated reactions other than simple polymerization.

Use of Natural-Gas Feed Stocks

The refiner who has natural gas available is naturally interested in the yields to be obtained from such charging stocks which will consist substantially of C_3 and C_4 compounds. The results of charging a mixture of 60 per cent of C_3H_8 and 40 per cent of normal C_4H_{10} indicates what may be expected from feed stocks of natural-gas origin. These data are given in Table 4.

Commercial Operations

The practicality of the operation discussed above has

Table 4

Re-cycling Operation

Run No.	1191
Pressure, lb. per sq. in.	1200
Temperature, ° F.	1035
Time, sec.	60
Feed composition, per cent by weight:	
C_3H_8	58.2
C_4H_{10}(n)	41.2
Liquid yield (net), per cent by weight	59.6

	Raw Product	Re-run Product
Gravity, API	65.2	64.6
ASTM Distillation in °F.		
Initial boiling point	97	112
5-per cent point	116	133
10-per cent point	122	137
20-per cent point	132	145
30-per cent point	143	156
40-per cent point	154	164
50-per cent point	168	174
60-per cent point	183	187
70-per cent point	206	203
80-per cent point	239	231
90-per cent point	325	281
95-per cent point	420	306
End point	456	379
C.F.R. motor method, octane No.*	89	93
Reid vapor pressure	10.2	10.0

*Blending value, 50 per cent in A-3 reference fuel.

been fully demonstrated by the polymerization unit at the Alamo refinery of the Phillips Petroleum Co. at Borger, Tex., which has been in commercial operation for an extended period of time. The operating schedule between clean-outs varies from 50 to 60 days. The feed stock has consisted largely of butanes; and, due to local conditions, complete re-cycling to ultimate yield has not been practiced. The yields, therefore, are not representative of a unitary process. The quality of the product, however, compares very favorably with that produced on the pilot plant when processing more varied mixtures.

The feed composition which a unitary process plant may be expected to process may vary from either propane or butane, or any mixture of these, to a complex mixture of C_2, C_3, and C_4, compounds in which the unsaturates amount to as high as 80 per cent. The entire plant may be considered to be made of two principal parts: the polymerization unit proper, and the gas and cycle recovery system. The polymerization portion of the unit will usually vary with feed-stock composition only to the extent of arrangement of reaction-coil surface. On the other hand, the precise type of gas and cycle-stock recovery system to operate at lowest over-all cost is quite dependent on feed compositions, and, therefore, will vary with this factor.

Accordingly, in the typical flow sheet shown in Fig. 1 the gas recovery system is not shown in detail. The balance of the plant clearly partakes of the general characteristics of a conventional cracking plant — both as to unit pieces of equipment, materials of construction, instruments, pumps, exchangers, etc. From heat and material balances the fuel consumption will vary between 6 and 10 per cent of the fresh feed stock charged. It should be noted, moreover, that this unitary process can easily be made a part of either a simple gas-oil or reduced-crude combination cracking unit with consequent economies in labor, fuel consumption, etc.

Table 5

Pilot-Plant and Commercial-Plant Operation

Charge	Product from Pilot Plant Stabilizer Reflux (Raw Product)	Pilot Plant Stabilizer Reflux (Clay-treated*)	Product from Commercial Plant on Butane Feed (Clay-treated)
Gravity, deg. API	65.1	66.5	61.4
ASTM Distillation in Deg. F.			
Initial boiling point	100	105	95
5-per cent point	117	120	114
10-per cent point	123	126	120
20-per cent point	134	134	133
30-per cent point	146	142	147
40-per cent point	156	152	163
50-per cent point	164	161	180
60-per cent point	178	172	203
70-per cent point	195	185	229
80-per cent point	227	208	271
90-per cent point	296	258	361
95-per cent point	377	298	425
End point	414	314	449
C.F.R. motor-method octane No.	.....	.....	79
C.F.R. motor-method octane No. (Blending Value)†	92	90	.....
Reid vapor pressure	10.7	.....	.....
Color	.....	30+	30+
Color after 8 hours in the sun	.....	30+	.....
Copper-dish gum, grams	.....	10.4	.....
Induction	.....	.....	120 min.

*Cut to 329 EP before clay treating. Treating loss, 1 per cent.
†Blending value 50% in A-3 reference fuel.

Table 6

Operating and Realization Statement

Operating Cost per Calendar Day:	
Operating labor	$80
Operating supplies	5
Maintenance	137
Fuel, at 80 cents per bbl.*	243
Steam, at 30 cents per 1000 lb.	23
Power, at ¾ cent per kwh	412
Water, at 1 cent per 1000 gal. (85 deg.)	117
General refinery expense	30
Total per calendar day	$1047

*Re-boiler heat for absorption system not included. Refinery waste heat used.

Debit:	
Net gaseous charge at 80 cents per bbl. of fuel equivalent	$1552
Direct operating cost	1047
Fixed charges	818
Total	$3417
Credit:	
Gas oil at 1.30 per bbl. (232 bbl.)	301
Manufacturing cost	$3116
Net gasoline produced, 2100 bbl. (88,200 gal.)	
Manufacturing cost, per gallon	3.53 cents

The characteristics of that part of the product of polymerization which boils in the motor-fuel range vary quite widely as functions of feed-stock composition and operating conditions. The use of a feed stock high in unsaturates (65-70 per cent by volume) at high conversions to liquid per pass appears to result in a product lower in gravity and paraffin content than does one in which the unsaturates lie between 15 and 35 per cent by volume. Aromatics and mono-olefins appear to be predominant in the product from the high unsaturated feed. That material resulting from the unitary-process operation on stabilizer reflux containing 30 to 38 per cent by volume of unsaturates will have an API gravity of 60-64 deg. when stabilized to a Reid vapor pressure of 10.5 lb. Its composition is rather paraffinic than olefinic or aromatic, and a considerable

Characteristics of Product

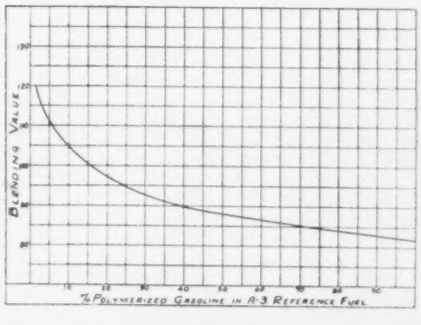

Fig. 3

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portion of the paraffins are *iso*-paraffins. It is low in copper-dish gum, and has a very satisfactory induction period.

Furthermore, this product is characterized by high volatility. It may be treated without appreciable loss of octane value to low copper dish gum and a stable 30+ Saybolt color, with either clay or a very small amount of acid. The inspections of typical products from processing various representative feed stocks by the unitary process are given in Table 5.

In Fig. 2 are given the distillation curves of two of the stocks shown in Table 6, and for a "blending polymer" reported produced by catalytic polymerization. Fig. 3 gives the relation between C. F. R. motor-method octane-blending value and the per cent of typical product blended with A-3 reference fuel.

Economics of the Process

A detailed analysis of this subject would require the presentation of process realization statements representative of the wide range of feed stocks to which the process is applicable. Several of these have been worked out, and the results are generally indicative. It is almost obvious that the three principal factors are cost of feed stock, operating utilities, and cost of plant. It appears to be current practice to appraise the charging stock at equivalent fuel value on a B.t.u. basis. The type of plant is substantially that of a cracking unit, with a highly-efficient gas-recovery and stabilization system. All of these figures will vary with location. An indicative figure, however, can be given of one specific case. This plant, assumed to be located in the south Mid-Continent area, was designed to handle 25,000,000 cu. ft. of refinery gas per stream-day containing 22.3 volume per cent unsaturates. The gas was valued at the equivalent of 80 cents per barrel of fuel oil. The value of liquid product other than motor fuel was placed at $1.30 per barrel. A condensed operating and realization statement is appended as Table 6, which shows the over-all operating cost to be 3.5 cents per gallon of gasoline produced.

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Non-Catalytic Polymerization of Gaseous Olefins

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(*Continued on page* 72)

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The Mechanisms Of Olefin Polymerization

By Gustav Egloff*

THE researches on the polymerization of olefins by means of heat and catalysts or both has been stimulated by the huge volumes available from the cracking process. In this report the mechanisms of the thermal and catalytic reactions of pure olefins are presented together with the effects of experimental conditions on the yields of polymers. A similar treatment of olefin mixtures is also presented.

Thermal Polymerization of Olefins[12a]

The earliest mechanism suggested for the formation of aromatics from ethylene was that of Berthelot[3] who assumed that the acetylene which formed combined with itself to yield benzene. The main objection to this theory has been that little or no acetylene was found during the pyrolysis. However, Groll[20] did not consider this a serious objection since acetylene polymerizes rapidly under heat. He argued that the steps in the formation of aromatics from olefins (except ethylene) could be represented by the following equations:

$$(1)\quad RCH{=}CHR' \rightarrow RC{=}CH + R'H$$

$$(2)\quad 3RC{=}CH \rightarrow C_6H_3R_3$$

THE remarkable increase in interest in polymerization processes and methods during the last 12 months has resulted in intensive investigation of both commercial and theoretical principles involved in the polymerization reactions by which these new processes, with or without catalysts, produce profitable yields of motor fuel from what has been hitherto practically a refinery waste product.

The accompanying study of the probable explanations of the various possible reactions in polymerization is one of the most complete that we have seen. The studies of various investigators have been reviewed and their solutions of the mechanisms presented. This article should prove a valuable addition to the concise literature on the subject, and of major interest to the busy technologist who may be investigating the subject—*Editor.*

The RC=CH could either polymerize or form an acetylene which under the conditions of operation would rapidly polymerize. In the case of ethylene, an additional assumption was necessary since demethanation (1) would yield carbon. The mechanism for the formation of styrene and naphthalene involved successive additions of acetylene to benzene followed by ring closure.

Bone and Coward[4] explained the formation of aromatic hydrocarbons from olefins by the polymerization of acetlyene or free radicals. They considered that at high temperature, dehydrogenation took place yielding CH≡ radicals which combined to form benzene:

$$6(CH{\equiv}) \rightarrow C_6H_6$$

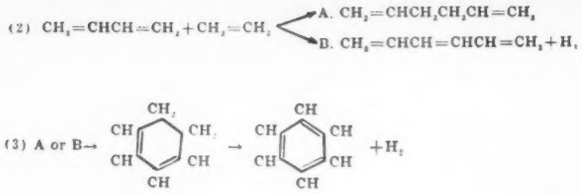
The first to postulate the intermediate formation of polymethylenes was Ipatieff[29a] who suggested that ethylene first formed hexamethylene; the higher olefins were thought to arise either by direct polymerization or from the polymethylenes by ring opening. The paraffins were thought to arise from the naphthenes by hydrogenation which caused ring opening or from splitting of side chains attached to a polymethylene nucleus. This theory was based upon results obtained at 380-400° and pressure of 70 atmospheres; no aromatics were found.

Davidson[6] suggested that butadiene combined with ethylene to yield cyclohexene which dehydrogenated to benzene. Hague and Wheeler[22] used the same general picture to explain the pyrolysis of olefins, for example, ethylene took the path of these equations to form benzene:

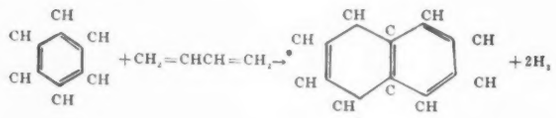
$$(1)\quad 2CH_2{=}CH_2 \rightarrow CH_3CH_2CH{=}CH_2 \rightarrow$$

$$CH_2{=}CH{-}CH{=}CH_2 + H_2$$

*Universal Oil Products Co.

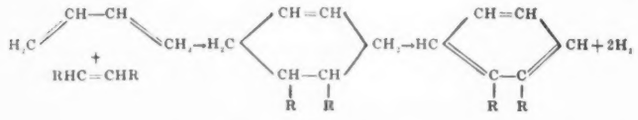


The formation of naphthalene was supposed to take place by the condensation of benzene with butadiene;



and anthracene and phenanthrene were supposed to be formed similarly from naphthalene and butadiene.

Based upon their work on ethylene, propene and the normal butenes, Wheeler and Wood[53] modified the Hague and Wheeler mechanism suggesting that no intermediate straight chain hexadiene was formed:



The first reaction is in accord with the work of Diels and Adler[8] who have proven that the addition of unsaturated substances to butadiene yields unsaturated cyclic compounds. In this connection, Farmer[15] has concluded that "of the two mechanisms which have been suggested for the production of hydroaromatic compounds, viz. (1) direct butadiene-olefin addition and (2) the intermediate formation of open-chain hexadienes or hexatrienes by addition of olefin to olefin, the former is the more probable."

The Wheeler and Wood mechanism consists of several reactions:

1. Formation of butadiene.
2. Reaction of butadiene with olefin to form a cyclohexene or a cyclohexadiene.
3. Dehydrogenation of the hydroaromatic.

An experimental verification of reaction (2) was obtained when mixtures of ethylene and butadiene, under conditions at which ethylene was stable, combined in about equi-molecular proportions to yield cyclohexene. The latter could be converted to benzene by heating above 550°C. Another verification of this reaction is found in the work of Frolich and Schneider[18] who passed a mixture of ethylene and butadiene through a tube at 725°C. They found benzene, hydrogen and a mixture, assumed to be hexadienes.

However, reactions supporting both the acetylene and butadiene-olefin mechanism are known. The former assumes the formation of acetylene, and Fischer and Pichler[16] found that it appeared to be an important intermediate in the polymerization of ethylene to benzene at 1000-1400°C.

Thus the tendency of ethylene to polymerize to benzene by the Wheeler mechanism (which is based on results at 550-800°C.), is less at 1000° to 1400° since the main reaction is decomposition to acetylene and hydrogen. Yet, butadiene was found in the ratio of 1 to 4 to acetylene at 1100° by Tropsch, Parrish and Egloff[51]. It appears, therefore, that more than one mechanism is necessary to explain the polymerization of olefins. However, it should be pointed out that acetylene reacts with ethylene to yield butadiene[3] which is the key to the Wheeler mechanism.

In an explanation offered by Storch[47] to account for his products, he postulated the following types of reaction:

$$C_2H_4 + C_4H_8 \rightarrow 2C_3H_6$$

$$C_2H_4 + C_4H_8 \rightarrow C_6H_{12}$$

$$C_3H_6 + C_2H_4 \rightarrow C_5H_{10}$$

$$C_5H_{10} + C_2H_4 \rightarrow C_3H_6 + C_4H_8$$

$$C_5H_{10} + C_2H_4 \rightarrow C_7H_{14}$$

To explain the polymerization of olefins, Hurd[23] has postulated the momentary existence of divalent radicals, such as $\dot{C}H_2—\dot{C}H_2$, in the case of ethylene:

$$CH_2=CH_2 \rightarrow \dot{C}H_2—\dot{C}H_2$$

the reactions of which are substantially those of a monovalent radical. It may collide with an ethylene molecule:

$$CH_2=CH_2 + \dot{C}H_2—\dot{C}H_2 \rightarrow CH_2CH_2CH_2\dot{C}H_2$$

giving rise to a product as the first step in polymerization. The latter radical may dehydrogenate to butadiene:

$$CH_2CH_2CH_2\dot{C}H_2 \rightarrow C_4H_6 + H_2$$

rearrange to a butene:

$$CH_2CH_2CH_2\dot{C}H_2 \rightarrow C_4H_8,$$

a substance found in large amounts at low temperatures and high pressures, or it may add to another ethylene molecule:

$$CH_2CH_2CH_2\dot{C}H_2 + CH_2=CH_2 \rightarrow CH_2CH_2CH_2CH_2\dot{C}H_2CH_2$$

to yield a radical which may undergo the same reactions as the analogous C_4 radical and form cyclic compounds by ring closure.

This new radical may continue to build up polymeric radicals through a repetition of the process until a stable condition is obtained. The stability of the radical depends upon the experimental conditions, which explains the difference in molecular weight of the products in different cases.

Indirect evidence for the formation of the primary divalent radical is offered by a compari-

son of the heats of activation of the hydrocarbon linkages:

$C{=}C{\rightarrow}\overset{|}{C}{-}\overset{|}{C}$ .....39,000±4,000 cal.

C—C→2C .....78,000 cal.

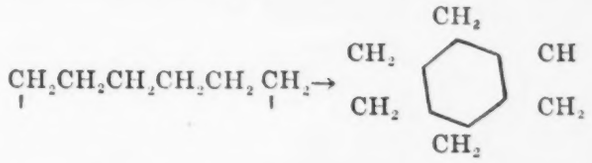
C—H→C+H .....93,000 cal.

The observation that polymerization is the initial process as the temperature is raised during the pyrolysis of an olefin is further evidence of the opening of the C=C bond as the primary reaction.

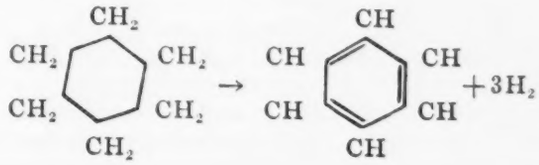
The polymer products reported by various investigators include dimers formed by the combination of two olefin molecules, trimers formed by addition of a third and higher polymers made up of increasing multiples of the original olefin molecule. It is interesting to note that the structural type of the dimer depends upon the structure of the original molecule, for example:

1. Monoolefins having a terminal methylene group yield open chain dimers.
2. Diolefins of the allene type form dimers which are unsaturated derivatives of cyclobutane.
3. Diolefins having conjugated double bonds yield a cyclohexane derivative having an unsaturated side-chain.

The formation of aromatics during the polymerization of olefins is due to secondary reactions. According to the formulation of Hurd, ring closure of the C_6 divalent radical:

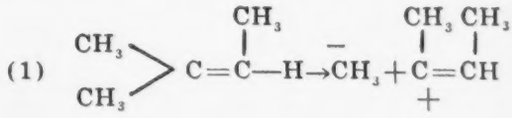


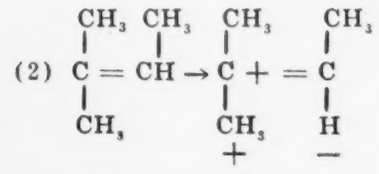
would yield the naphthene, cyclohexane, which by dehydrogenation would give benzene:



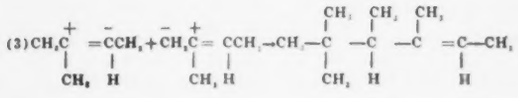
Another suggestion based upon free radical formation is that of Berl and Frost[2] who postulated a C-H break with subsequent condensation of the free radicals. However, it is difficult to see why a C-H bond with an energy of activation of 93,000 cal. would become activated when only about 39,000 cal. are necessary to open one of the C=C bonds.

A mechanism based upon the theories of free radicals and electronegativities was proposed by Kline and Drake[37]. The two free radicals formed by scission of a molecule are designated as positive or negative. Thus in the case of trimethylethylene the molecule was thought to be broken in two ways:

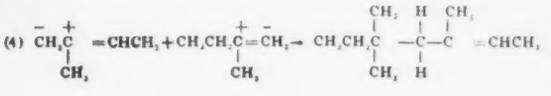




These radicals would combine to form 3, 4, 5, 5-tetramethylhexene-2:



but (1) might also combine with its isomer, $(CH_3CH_2)(CH_3)\overset{+}{C}$ and $\overset{-}{CH_2}$ to form 3, 5, 5-trimethylheptene-2:

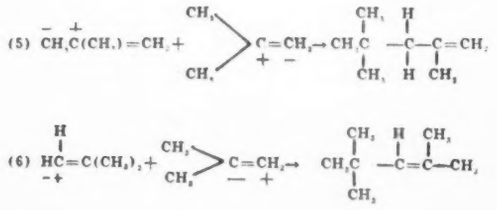


Both of these condensation products have been identified.

The same mechanism has been applied to predict the products of isobutene polymerization. The products observed could be accounted for on the basis of the activation taking place, 80 per

Dr. V. N. Ipatieff, internationally known authority on catalysis, who has had a prominent role in development of catalytic polymerization of hydrocarbon gases

cent according to (5) and 20 per cent according to (6):



A kinetic picture of the mechanism of polymerization of ethylene is offered by Pease[41] who observed that the velocity constant for a second order reaction increased as the reaction progressed. This fact was attributed to secondary reactions between butene, the primary product, and an additional quantity of ethylene. He used a mechanism originally proposed by Taylor to explain the formation of butene from ethylene. Essentially, it consisted in the collision of two ethylene molecules to yield an unstable complex (C_4H_8). This product was expected to have a short life because its energy content should be in excess of that necessary to dissociate. Stabilization might occur by another collision with an inactive molecule or by collision with the wall. The latter possibility was eliminated by Pease who obtained the same results in packed and unpacked tubes. Thus, the observed second order reaction constant must be explained by a triple collision mechanism which Pease questioned. Kassel[36], however, considered a life of 10^{-8} second for the complex during which time a collision would not constitute a triple collision.

The effects of changing the conditions upon the polymerization of olefins is illustrated as follows. In the case of ethylene, Wood (see Ref. 13) found that polymerization to higher olefins reached a maximum (13.7 per cent) at 500°C. and 3 hours contact time. At temperatures above 500°C. decomposition to hydrogen and methane were predominant reactions. A similar conclusion was reached by Dunstan, Hague and Wheeler[10] who found maximum conversion (12 per cent) at 500° C. also.

The latter work also shows the effect of contact time. At 500°C. the yield increased from 2.75 per cent higher olefins in 45 minutes to 12 per cent in either 3 or 6 hours. The yield of higher olefins at 600°C. decreased 5.3 per cent in 12 minutes to 0.9 per cent in 360 minutes.

The variation in pressure during the polymerization of the olefins not only increases the yield of polymers but actually may change the course of the reaction. For example, Egloff and Schaad[12] obtained a 66-73 per cent conversion of ethylene in an autoclave at 340° with an initial pressure of 50 atmospheres; under atmospheric pressure, ethylene just begins to decompose at this temperature. Similar results were obtained by Dunstan, Hague and Wheeler[11] who subjected ethylene to pressures of 1325 and 1410 pounds per square inch at 380 to 390°C. and obtained yields of 92 and 86.5 per cent, respectively. The experimental work of Booley (see Dunstan, Hague and Wheeler[10]) illustrates the effect of pressure and temperature upon the polymerization of ethylene and is summarized in table 1.

In the case of the higher olefins the effects of time, temperature and pressure would be expected to be the same as with ethylene. That such is the case for propylene was proven by Sullivan, Ruthruff and Kuentzel[49], whose data are summarized in table 2.

In the above discussions there were reviewed, essentially, two types of mechanisms of polymerization for non-catalytic pyrolysis. One consisted of the intermediate formation and momentary existence of free radicals and their reactions to form polymers, while the other consisted of the formation of an intermediate hydrocarbon compound or compounds. No mention was made of the mechanism of the formation of these intermediate substances except to point out the net reaction of their formation. The sum of these intermediate net reactions was the mechanism of polymerization. It was also observed that a mechanism which was satisfactory under one set of conditions was not so under others since the possibility of formation and relative stability of the intermediates are the determining factors of a mechanism.

Catalytic Polymerization of Olefins

The mechanisms of polymerization in catalytic olefin pyrolysis change with the conditions just as do those in the noncatalytic pyrolysis. The change is more pronounced in those cases in which an intermediate ester is formed as, for example, when phosphoric acid or aluminum chloride is the catalyst.

In the treatment of ethylene with phosphoric acid, Ipatieff and Pines[35] obtained olefins.

Table 1

Polymerization of Ethylene (Booley)

Pressure lbs./in.² above atmospheric	Temperature, °C	Per cent converted to liquids	Rate of flow liters/hr.
0	650	0.0	10
50	650	13.3	10
100	650	20.7	10
150	650	24.4	10
0	650	0.7	5
50	650	20.8	5
100	650	29.6	5
150	650	32.6	5
0	700	7.2	10
50	700	30.0	10
100	700	32.0	10
150	700	35.4	10

Table 2

Polymerization of Propylene (Sullivan, Ruthruff and Kuentzel)

Temperature °C.	Contact Time Min.	Pressure lbs./in.²	Conversion Wt. Per Cent
427	3.8	1000	5.5
427	6.4	2000	41.7
454	3.4	500	6.0
454	3.3	1000	22.9
454	3.4	2000	32.7
455	5.7	500	16.3
456	5.9	2000	48.5

paraffins, naphthenes and aromatics which they explained in the following way:

1. Formation of ethyl phosphates.

2. Decomposition of these esters to yield polymers and naphthenes.

3. Dehydrogenation of the naphthenes to aromatic hydrocarbons.

4. Hydrogenation of olefins to paraffins by the "nascent" hydrogen from the naphthenes. (Molecular hydrogen under the same conditions does not react with the olefins.) Thus the dehydrogenation of the naphthenes and the hydrogenation of olefins takes place simultaneously.

Besides the four main reactions, the following must be added to explain the formation of ethyl benzene, polycyclic naphthenes and isomeric olefins.

(a) Alkylation of aromatics with olefins to yield alkyl aromatics.

(b) Partial dehydrogenation of naphthenes to yield polycyclic naphthenes.

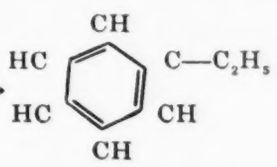
(c) Isomerization of olefins.

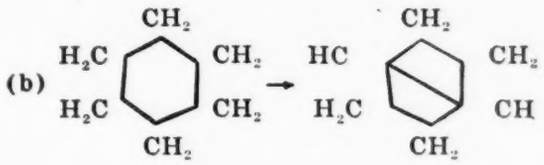
Using ethylene as the olefin, the following reactions are written to illustrate the theory:

1. $C_2H_4+H_2PO_3(OH)\rightarrow H_2PO_3(OC_2H_5)$ or,
$2C_2H_4+HPO_2(OH)_2\rightarrow HPO_2(OC_2H_5)_2$ or,
$3C_2H_4+PO(OH)_3\rightarrow PO(OC_2H_5)_3$

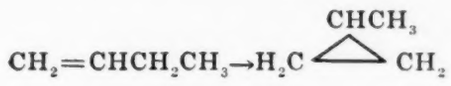
2. $HPO_2(OC_2H_5)_2\rightarrow C_4H_8+PO(OH)_3$ or,
$PO(OC_2H_5)_3\rightarrow cycloC_6H_{12}+PO(OH)_3$

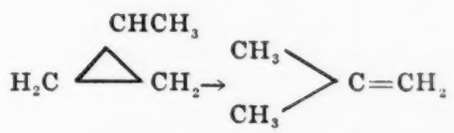
3.-4. $C_6H_{12}+C_4H_8\rightarrow C_4H_{10}+C_6H_6+2H_2$

(a) $C_2H_4+C_6H_6\rightarrow$ 

(b) 

(c) $2C_2H_4\rightarrow CH_2=CHCH_2CH_3$





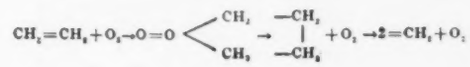
The presence of aluminum chloride causes the polymerization of olefins to dimers or lubricating oils, depending upon the conditions.

Hunter and Yohe[29] observed that ethylene was absorbed by aluminum chloride at room temperature. A small amount of oil was produced. Introduction of dimethylaniline, trimethylamine or ether inhibited the reaction and it was thought that the formation of a stable complex with aluminum chloride stopped the reaction. A crystalline product was formed by saturation of an absolute alcoholic aluminum chloride solution[19]. Its composition was approximately $AlCl_3.2C_2H_4.C_2H_5OH$. On warming, ethylene and hydrogen chloride were evolved. (A compound $(AlBr_3.2C_2H_4)_n$ was isolated by Gustavson[21].)

This evidence and the fact that all the investigators report a heavy viscous oil containing aluminum and chlorine proves that a complex is formed which may catalyze the formation of polymers. Ipatieff and Grosse[34] reported that pure aluminum chloride did not react. Only in the presence of moisture, hydrogen chloride or aluminum chloride of ordinary purity did polymerization occur which suggests the importance of hydrogen chloride in the reaction and questions the role of aluminum chloride. When reaction did take place, two layers were obtained. The upper was a milky white and predominantly paraffinic with a very small amount of aromatics and unsaturates. The lower layer was a dark red, viscous addition product of aluminum chloride with unsaturated cyclic hydrocarbons which were released on the addition of water.

Stanley[46] believed that the formation of the numerous products by the action of aluminum chloride could be explained on the basis of three well-known reactions, namely, (1) polymerization of olefin to higher olefin; (2) isomerization to those olefins to produce the corresponding cycloparaffins, and (3) cracking of the latter under the influence of aluminum chloride to produce light paraffin hydrocarbons and heavy oils less rich in hydrogen.

In order to explain the accelerating effect of oxygen on the polymerization of olefins, Lenher[38] postulated the formation of an intermediate oxide which decomposed, yielding a bivalent radical of one or more C atoms. Thus for ethylene:



these radicals may be formed: $=CH_2$, CH_2CH_2.

The effect of changing the temperature, pressure, or time depends upon the presence of a catalyst and varies with different ones. For example, an increase in the temperature in the presence of aluminum chloride[46] speeds the polymerization, shortens the life of the catalyst and changes the nature of the products. By decreasing the feed rate 67 per cent, Ipatieff and Egloff[33], using "solid phosphoric acid," increased the yield of polymer gasoline 20 per cent. The pressure was 100 pounds per square inch and the temperature 204°C.

Optimum yields of polymer depend upon time, temperature and pressure plus the catalyst in the catalytic reactions. The results of investigators are summarized in tables 3, 4 and 5.

The most complete single research upon the polymerization of olefins by means of aluminum chloride was recorded by Sullivan, Voorhees, Neeley and Shankland[50]. Table 6 summarizes

the results obtained at 57.2°C. for 8 hours. Naphtha was used as solvent and all other conditions were as constant as possible. The hydrocarbons were synthesized from the alcohol over alumina.

The highest yield from pentenes was obtained with 1-pentene and the lowest with the most branched—trimethylethylene. Thus it can be concluded that best yields are obtained with normal olefins which have a terminal methylene group. A similar conclusion may be reached in the case of the butenes, and that a terminal methylene facilitates polymerization more than a branched chain.

Table 3
Thermal Polymerization of Ethylene

Temperature °C.	Time	Pressure (Atmos.)	Gasoline Yield % by Weight	Polymers other than Gases % by Weight	Polymer Gas % Yield by Volume	Remarks	Ref. No.
350-500	.....	10.0	.....	.....	50.0		41
377	1.0-3.0 hrs.	0.19	.....	.....	50.0		47
379.5	1.10 hrs.	42.0	40.5	.....	69.6 by wt.		12
380-388	3.0 hrs.	95.9	60.0-70.0	86.5	.....	mild steel tube	11
400	.....	50.0-100.0	.....	100.0	.....		45
.....	.....	34.0	.....	80.0	.....	temperature slowly raised for each pressure	45
.....	.....	51.0	.....	92.0	.....		
.....	.....	90.0	.....	97.0	.....		
500	3.0 hrs.	1.0	.....	.....	13.7		13
500	3.0 or 6.0 hrs.	1.0	.....	.....	12.0		10
575	4.0 min.	1.0	.....	.....	7.9		17
700	10.0 liters/hr.	10.2	.....	35.4	0.5		10
700-750	.....	1.0	.....	60.0	.....		44
800	50.0 sec.	1.0	10.7	28.9	1.4		22
800	50.0 sec.	1.0	17.7	36.1	1.25		53
802	10.6 sec.	.....	.....	75.0	.....	ascoloy tube	25
800-900	.....	1.0	.....	43.0	.....		2
1000	0.004-0.005 sec.	1.0	.....	83.5	.....	8.5% decomposition	48
——Optimum conditions——			65.0-70.0	.....	.....		49.

Table 4
Thermal Polymerization of Higher Olefins

Hydrocarbons	Temperature ° C.	Time	Pressure (Atmos.)	Gasoline Yield Per Cent by Weight	Polymers other than Gases Per Cent by Weight	Per Cent Yield by Volume	Remarks	Ref. No.
Propene	429	16.9 sec.	2000	69.5	64.0	.....	Octane No. 75	45
Propene	575	4.0 min.	1	.....	2.6	2.8	31.1% decomposition	17
Propene	700	25.0 sec.	1	.....	27.6	39.6	5.08% decomposition	27
Propene	700	25.0 sec.	1	.....	27.0	.....	.....	25
Propene	800	50.0 sec.	1	19.00 (to 170° C.)	40.6	0.80	.....	53
Propene	802	7.3 sec.	1	.....	37.2	.....	Ascoloy tube	25
Propene	1100	0.00118 sec.	(50 mm.)	.....	.....	5.0	.....	51
		13.0 sec.	1	.....	30.0	.....	.....	26
2—Butene	650	11.0 sec.	1	.....	30.0	.....	.....	26
1—Butene	650	4.0 liters/hr	1	22.45 (to 170° C.)	39.62	1.47	.....	53
1—Butene	750	4.0 liters/hr.	1	23.24 (to 170° C.)	39.62	2.54	.....	53
2—Butene	750							
Isobutene	652	13.0 sec.	1	.....	63.0	.....	11.0% decomposition	28
Isobutene	700	18.0 sec.	1	.....	63.0	.....	47.7% decomposition	28
Isobutene	700	4.1 sec.	1	.....	62.0	.....	21.0% decomposition	25
2—Pentene	700	11.4 sec.	1	.....	41.0	.....	Ascoloy tube	25
4—Methylpentene	625	5.5 sec.	1	.....	30.9	.....	87.0% decomposition	24
Trimethylethylene	.....	32.0 days	1	.....	77.0	.....	Heated	14

Table 5
Catalytic Polymerization of Olefins

Temperature °C.	Time or Feed Rate	Pressure (Atmos.)	Catalyst	Gasoline Yield Per Cent by Weight	Polymers other than Gases Per Cent by Weight	Per Cent Yield by Volume	Remarks	Ref. No.
			ETHYLENE					
Room	8.0 hrs.	130.0	Boron fluoride	.....	85.0–95.0	.....	.....	40
100–180	.....	60.0	Aluminum chloride	.....	85.0	.....	Naphthalene added	42
250–260	.....	.....	Aluminum chloride	.....	27.0	.....	Tetralin added	42
275	50.0 –60.0 hrs.	70.0	Zinc chloride	.....	44.0	.....	.....	1
290–300	.....	.....	Zinc chloride	.....	33.0	.....	Coal tar added	42
330	.....	38.7–49.4	Phosphoric acid	40.4	80.8	18.8	.....	35
379–381	2.67–3.67 hrs.	38.0–44.0	Alumina	50–58	63.5–73.5	.....	.....	12
490	.....	1.0	Oxygen	.....	.....	9.3	.....	38
800–825	5.0 liters/hr.	1.0	Iron tube	.....	32.1	.....	.....	20
			PROPENE					
204	.....	51.0	Phosphoric acid	.....	55.0	.....	.....	30
516	7.8 sec.	1.0	Oxygen	.....	.....	61.6	.....	38
800	5.0 liters/hr.	1.0	Iron tube	.....	40.0	.....	.....	20
			BUTENES					
130	6.5 liters/hr.	1.0	Phosphoric acid	.....	92.0	.....	.....	31
650–700	.....	1.0	Silica gel	.....	33.0–37.0	.....	.....	39
800	5.0 liters/hr.	1.0	Iron tube	.....	40.0	.....	.....	20

Polymerization of Mixed Olefins

The mechanisms of polymerization of mixed olefins should be analogous to those of the pure olefins which have been discussed. Also, highly desirable hydrocarbons might well be synthesized from the more common ones. For example, butadiene was obtained by Berthelot[3] from ethylene and acetylene when he heated the mixture to the softening point of glass. As another example, the reaction of ethylene and butadiene to yield benzene, hydrogen and a mixture of hexadienes is important. This reaction was found to take place under conditions at which ethylene alone was stable[53]; Frolich[18] also obtained similar results at atmospheric pressure and 725°C.[18] The condition of turbulent flow hastened the polymerization of mixed olefins in quartz tubes; the extent varying with temperature and time of contact.

The pyrolysis of ethylene mixtures was studied by Dunstan, Hague and Wheeler[11] who obtained results which are summarized in table 7.

The polymerization of a cracked gas which contained 39-52 per cent olefins at high temperatures and pressures to gasoline was shown by Wagner[52] to produce 1.7 gallons per 1000 cubic feet of gas at 518°C. and pressure of 800 pounds. An increase in temperature to 705°C. increased the per cent of aromatics formed.

The use of catalysts facilitates the polymerization of mixtures of olefins with other hydrocarbons. Ethylene and acetylene reacted in the presence of charcoal at 150°C. to yield ethylacetylene. The latter was isomerized to butadiene when passed over pumice at 300°C. A similar reaction of acetylene and propene was obtained under the same conditions[9]. The product was n-propyl-acetylene and it isomerized to isoprene when heated. The polymerization of propene in the presence of phosphoric acid was hastened by the addition of butene[30].

The polymerization of mixed hydrocarbons containing olefins has found application as a result of the work of Ipatieff, Corson and Egloff[32] and Ipatieff and Egloff[33] who employed a "solid phosphoric acid" catalyst. Their run data on a once-through basis, using a stabilizer reflux "which contained 37.5 per cent propene-butenes," are quoted as follows:

Characteristics of the steam distilled polymer gasoline are presented below:

The fact that ethylene reacts with hydrocarbons other than olefins is shown by the work of Ipatieff and Grosse[34] and Slanina, Sowa and Nieuwland[43]. The former found condensation with paraffins in the presence of aluminum chloride and the latter observed alkylation of benzene with propene in the presence of boron fluoride and acids. The rates of the reactions were directly proportional to the acidity of the catalyst.

Table 6

Polymerization of Olefins by Aluminum Chloride (Sullivan, Voorhees, Neeley and Shankland)

Hydrocarbon	Yield of oil, % by weight	Viscosity index*
Propylene	33.3	20
1-Butene	46.4	50
2-Butene	33.3	21
Isobutene	42.0	67
1-Pentene	59.8	82
2-Pentene	38.5	27
3-Methylbutene-1	50.8	0
2-Methylbutene-1	34.5	11
Trimethylethylene	29.3	—74

*The viscosity index (Dean and Davis[7]) was calculated for a viscosity of 85 at 210°F.

Table 7

Pyrolysis of Ethylene Mixtures (Dustan, Hague and Wheeler)

Hydrocarbon	Per cent	Temperature °C	Maximum pressure lbs./sq. in.	Time Hours	Liquids per cent by weight of Olefin charged
Ethylene	58.0	390-400	1010	3.5	87.7
Propylene	42.0				
Ethylene	51.5	382-390	1390	3.0	85.3
Methane	48.5				
Ethylene	49.2	387-392	1220	2.5	65.1
Ethane	50.8				

Table 8

Gasoline from Stabilizer Reflux

Operating conditions:			
Hours on test	72	72	72
Gage pressure, lbs./sq. in.	100	100	100
Temperature, °C.	204	204	204
Inlet gas rate, cu. ft./hr./lb. cat.	4.9	3.4	2.1
Olefin content of gas:			
Propene and butenes, per cent	37.5	37.5	37.5
Olefin polymerization:			
Propene and butenes, per cent	72	81	89
Gallons of liquid polymer and of gasoline per 1000 cu. ft. of gas:			
Liquid polymer	6	6.9	7.2
Gasoline (I. B. P. 150° F.) (E. B. P. 389° F.)	5.4	6.2	6.5

Table 9

Polymer Gasoline

Gravity, °A. P. I. at 60° F. (15.6° C.)	62.8
Specific gravity at 60° F. (15.6° C.)	0.728
Color, °Saybolt	30+
Color stability (2 hrs. of noon June sunlight)	21
Gum, mg./100 cc. (Copper Dish)	4
Octane Number (C. F. R. Motor Method)	82
Octane Blending Value (C. F. R. Motor Method) (25% in Fuel A-3)	121
Reid Vapor Pressure at 100° F., lbs.	5

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(*Continued from page* 63)

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Saturated Hydrocarbons Unfit For Cutting

Oxy-acetylene flames preheat steel faster per unit of heat developed than any other commercially available fuel gas and require the least amount of oxygen per heat unit developed and per equivalent cut of steel, Dr. G. V. Slottman told members of the International Acetylene Association meeting at Cleveland, Nov. 13.

Dr. Slottman based his conclusions on detailed and exhaustive study in the laboratories of Air Reduction Sales Co. during the past year for determining the operating characteristics of the several hydrocarbon cutting fuel gases. The gases were employed in a variety of commercially available oxy-fuel gas cutting torches, in cutting mild steel plate varying in thickness from one half to four inches.

Attention was called to previous studies reported at the 1934 convention which, he said, demonstrated that hydrocarbon gases, including city gas, natural gas, and the petroleum distillates, ethane, propane and butane, require complete combustion with oxygen in order to generate their maximum flame temperatures. It was shown that acetylene, on the other hand, because of its high endothermal heat liberation, reaches flame temperatures in the order of 6000° F., some 1000° higher than the maximum flame temperatures of the saturated hydrocarbons, with an oxygen gas ratio of less than 50 per cent of that theoretically required for complete combustion.

The following table was presented to show the relative volumes of fuel gases to produce equivalent rates of heating:

Fuel Gas	Vol. of Fuel Gas, cu. ft. per hr.	Vol. of Oxygen, cu. ft. per hr.
Acetylene	10	17.0
City gas	75	56.3
Natural gas	28	56.0
Propane	12	54.0

The study was said to definitely preclude the possibility that oxygen savings can be effected in the cutting oxygen stream by the use of the saturated hydrocarbon fuels.

It was found that the optimum oxygen gas mixing ratios for the highest flame temperatures were:—for city gas, 0.75 to 1; for natural gas, 2.0 to 1; for propane, 4.5 to 1; and for acetylene, 1.7 to 1. These exact ratios are hard to attain in practice.

Conservation of Oil Given Impetus By Polymerization Processes

By Arch L. Foster
N. P. N. Staff Writer

BY POLYMERIZATION of saturated and unsaturated hydrocarbons of low molecular weight, now practically waste products of petroleum and natural gas, 100,000,000 barrels of high octane number motor fuel may be produced by the employment of processes now either commercially practical or approaching that stage of development. This can be accomplished without increasing the crude production by a single barrel, competent and informed authorities state.

The import of these figures, which are based on creditable production of gases and yields of motor fuel therefrom which have been obtained in actual commercial practice, is realized only after careful study of what they mean, in comparison with present motor fuel production by methods which have become fairly well conventionalized. In 1934 the U. S. Motor fuel production was reported by the Bureau of Mines as 416,932,000 barrels.

The estimated potential production of motor fuel from natural and refinery gases above represents more than 20 per cent of that now produced from petroleum and natural gasoline. This potential production may be made from raw products which at present do not enter into the making of motor fuel. The yields from conventional sources and processes would not be affected by the widespread adoption of polymerization processes. The thermal efficiency of the average motor fuel which could be supplied by the refiner would be increased by several per cent.

It must not be assumed, however, that the gasoline output, and therefore the gasoline market, is to be immediately and irrevocably upset by the meteoric development of polymerization processes, and the early and universal installation of plants by every refiner and natural gasoline producer. Such is not the case. A half-dozen units are now operating or contracted for, their total capacity being probably 10,000 to 12,000 barrels of very high octane number fuel per day. The actual production is considerably less than the total capacity. Two of these units are not yet erected.

The total estimated figures given above are merely the possibilities, if all gases from both sources were processed to yield motor fuel at the rate of yield already proven practicable commercially. Without doubt it will require years to adapt plants, and to erect them, to process even the major portion of this gas. The rate of crude production, the gasoline demand and its market price, new developments in cracking and the octane number which cracked gasoline possesses at any given time in the future, and the cost of operating polymerization plants in competition with a large number of other plants,—all these factors will influence the rate of adoption of polymerization processes.

What is Polymerization?

Definitely speaking polymerization means the combination or recombination of hydrocarbons, usually of unsaturated or olefinic nature, to form hydrocarbons of a greater number of carbon atoms in the molecule. Practically, it means the combination of either saturated or unsaturated hydrocarbons of two, three, four, or five carbon-atom molecules, to form molecules of five to ten or more carbon-atom molecules. If saturated molecules are polymerized, the customary treatment is initiated by cracking these hydrocarbons to form olefins or unsaturates, which are then polymerized to form the larger and higher boiling molecules.

Two principles are employed to accomplish this polymerization. By the use of catalysts the polymerization of unsaturates is practicable at relatively low pressures and temperatures, as typified by the Universal process using phosphoric acid as catalyst. This method yields commercially three to five gallons of motor fuel per thousand cubic feet of charge gas, containing 20 per cent or more of unsaturated material.

The thermal process, typified by the Gyro process, on cracking still gases, or the Phillips process on either still gases or natural gas (saturated) hydrocarbons, is essentially two steps; cracking the gas to form unsaturates, and subsequent polymerization at high temperatures and pressures to form materials boiling in the motor fuel range. In either process, the reacting materials are the unsaturated products; in one the olefin gases have been produced by another operation, the cracking of petroleum charging stocks. In the other the gases must be cracked before reaching the polymerizing stage.

It has been estimated that, from the more than three billion cubic feet of cracked gases made in cracking units in this country, about 25,000,000 barrels per year of polymerized motor fuel can be made commercially. From the between two and three trillion cubic feet of natural gas produced an-

nually, at least three times as much motor fuel can be made by thermal, or thermal and catalytic methods now proved practicable.

It may be assumed that, with some exceptions, the cracked gases at refineries will be utilized first. These gases are concentrated; no additional recovery methods or equipment are necessary; the "tail-pipe" gas from the cracking stills may be conducted directly to the polymerization unit, usually without any additional compression.

There are between 100 and 150 refining plants in this country which produce enough cracked gas to warrant the installation of polymerizing equipment, the number depending somewhat on the size of the smallest unit which is economical to operate. This size has not been definitely determined so far, chiefly because of the lack of long experience in operating these units under widely varying conditions of gas supply, local operating cost variations, etc.

A conviction is growing, however, among many technologists, that the present uses of polymerization, its present "hookup" in the refinery, will be changed and improved considerably, during the next few years. So far as we know, the specific process method, either thermal or catalytic, has been and is being used alone, without mixing the two methods.

This is done for obvious reasons, for the same reasons that the experimenter in the laboratory reduces all but one variable to a constant—and then determines the effect on the reaction of that one variable when all others are constant. It is desirable to know with reasonable exactness just what can be accomplished by catalysis, or by heat and pressure, alone. When that is known then combinations of the two, or of either or both with other processes, such as hydrogenation, may be investigated to determine what improvements can be made in the final result by the combination of these different processes.

Other possibilities are in the offing, the extent of which it is too early to estimate now. Concentration of a given type or similar types of hydrocarbons by means of solvents, by refrigeration, or by other means not yet completely investigated, offers possibilities as yet uncertain in their extent or their practicability. By any such means, assuming that these means have been made or may be made practicable commercially, special fuels may be produced which will show qualities, and permit performances which are now dreamed of only by the more far-seeing of technologists.

THE average compression ratios of 1936 engines appear, from preliminary figures, to be about 6.05 to 1 with the highest at 6.8 to 1, as compared to 6.00 to 1 average for 1935, and 5.15 to 1 for 1930. Aviation engine builders are shooting at very much higher ratios, and are now studying the advantages of engines built for octane number fuels of 100 or higher, in their continually intensifying quest to increase cruising radius, lower fuel load ratios, and increase payloads and practicable commercial speeds. Weight-to-horsepower ratios of two to one have been considered high and very satisfactory, a short time ago. A ratio of one to one overall is probably not too much to expect when our fuel, metallurgical, and design technologies have been developed to take advantage of principles of each which are already known and merely await the practical solution of certain difficulties.

The adoption of combinations of these processes points inevitably to far greater flexibility in operation and in type and yields of products, for the refiner who uses them. With a plant at his command which is widely flexible in the type of operation and in the kinds of products it can make, the refiner or gasoline manufacturer is in position to "change front" to meet a more widely varying market, an ability even more important in industry than in military strategy.

The two prime considerations in motor fuel, now and as far into the future as we can see, are anti-knock rating and volatility. Volatility may be obtained by cracking, from natural gasoline products, vapor recovery. Plenty of volatility exists and may be had for the asking.

We are limited in practical volatility considerations by engine fuel system designs, and by atmospheric temperatures and pressures. Any fuel which reaches approximately fifteen pounds vapor pressure at any given operating temperature and 760 millimeters of mercury atmospheric pressure will boil and vapor lock, unless the fuel system is provided with refrigeration or with special equipment to maintain a higher pressure on the liquid fuel. The latter solution is limited by practical considerations of cost of equipment and general car design. In aviation the limitations are less restrictive by reason of greater permissible cost, but more restrictive in weight considerations.

Higher anti-knock ratings may be obtained from a given raw material only by means of molecular rearrangement, so far as we now know. Polymerization alone produces both olefinic hydrocarbons in and above the motor fuel boiling range, and, under varying conditions, hydrocarbons of the benzene series, which are the most valuable from the point of view of anti-knock. In combination with, for example, hydrogenation more saturated hydrocarbons may be produced, simplifying refining treatment, and boosting over-all yields. Actual anti-knock values may also be increased or not, depending on operating details.

This combination of at least catalytic polymerization with hydrogenation is already a fact. It is understood unofficially that hydrogenation is, or may be combined with polymerizing operation in the Shell unit going into the refinery at Wood River, in connection with the huge new Dubbs unit there. Standard of California has just announced a combination catalytic polymerization — hydrogenation unit soon to go into construction at Richmond. These units should both turn

out motor or aviation fuels of 100 octane number or better, more nearly saturated as to olefinic bonds than straight polymerized fuels. Data regarding comparative yields are not yet available to the writer, but, judging from reports by Haslam and Russell, on yields from hydrogenation of heavy oils to gasoline, of more than 100 per cent by volume, the yields from these combination plants should be higher than are now obtained with the single polymerizing unit.

The larger field for polymerization, already well penetrated but by no means thoroughly known is that of pyrolysis and polymerization of saturated gases. This includes the saturated hydrocarbons making up 50 per cent of more of refinery gases, and the much greater amount of ethane propane, and butane found in natural gas and available most conveniently as the overhead waste product from natural gasoline plants. Some of these hydrocarbons now find an outlet as special fuels for specially equipped trucks and automobiles, and are maintained under pressure in the liquid state until used in the engine. They are also disposed of in considerable quantites as "bottled" gas, for use as domestic and industrial fuels where regular natural gas supply is not available.

However, all these uses dispose of only a small part of the total quantities available. Much of the butane and all of the propane and ethane from natural gasoline production is either "wasted" to natural gas lines, for local plant fuel, or into the air, for want of a sufficient market at present. The usefulness of polymerization and/or hydrogenation processes in making this raw material available for motor and aviation fuels can hardly be overestimated.

As mentioned above, the total potential production of motor fuel from this source may be 75,000,000 barrels per year, or nearly 20 per cent of our present motor fuel yield, without refining a single additional barrel of crude oil.

Blending of even ten per cent of this high octane number motor fuel with 90 per cent of our present gasoline should raise the octane rating of the blend considerably, say five octane numbers. Raising the octane rating of the average fuel from 70 to about 75 would permit appreciable increases in compression ratios and pressures in automotive engines by say, one unit, or from 6 to 1 to 7 to 1, average. The increase in overall engine efficiency made practicable by this increase in ratios should exceed in percentage the proportion of the polymerized fuel blended.

ALTHOUGH early to prophesy on this subject, it seems reasonable to assume that the eventual development of polymerization methods will include both pyrolysis and polymerization of the cracked gases, with or without the addition of hydrogenation to the system, as developments dictate. Certainly, so far as can now be seen, the polymerization of saturated gases necessitates cracking to unsaturated status for the first step. For this reason, informed refiners believe that thermal or pyrolytic polymerization will prove to be a more valuable tool, when utilization of the tremendous quantities of saturated gases is generally practicable.

There is no reason, in the knowledge of the writer, why catalytic polymerization cannot be combined with the prior step of cracking the saturates, to result in a combination unit which is probably more efficient than either used alone. High temperatures and pressures are essential for gas cracking, as is well known. Catalysis, at present appears to offer quite as good yields of motor fuel, of possibly slightly higher octane rating than that from thermal processes. Catalysis, given practicable catalysts, which we now have, which can be easily, cheaply and efficiently rejuvenated, enables the refiner to polymerize at lower pressures and temperatures, reducing the processing costs as well as permitting the use of lighter and thus cheaper equipment of longer practical life.

The recent developments in catalytic dehydrogenation of light hydrocarbons as a preliminary step to polymerization shows great promise, as pointed out by Egloff elsewhere in this issue. Such a method of pyrolysis may if commercially successful, reduce the over-all cost of polymerization, because of the lighter weight equipment which may be used at the lower pressures and temperatures employed; and because of the lower costs for compression and heat.

Whether hydrogenation will eventually become an essential part of the system, or will be reserved for the manufacture of special products of especially high qualities remains to be seen. Technologists are averse to making flat statements or predicting anything very far into the future. The possibilities are too great while the unknowns are too numerous now.

Natural Gasoline Maker's Position

To the natual gasoline manufacturer, the outlook holds probably both an advantage and a disadvantage. It seems apparent now that the advantage will be of far greater utility to him than the disadvantage can be expected to offset. In other words, polymerization should prove eventually to be far more useful than damaging, to him.

The great potential advantage of polymerization applied to natural gas and its products is in the greater outlet supplied for products from ethane, propane, and butane, all except part of the last of which is now wasted so far as motor fuel is concerned, with the small exceptions as noted above. Production of molecules of five to ten or twelve carbon atoms by means of pyrolysis and polymerization, by whatever method or methods combination this may be achieved, should prove entirely practicable, economically and technically speaking. As now evaluated, the bulk of these raw materials is waste or practically so.

To the unbiased observer at

this stage, therefore, polymerization processes loom as another and valuable tool by the use of which the gas operator can increase his output of salable motor fuel or fuel blending material. To convert any considerable portion of natural hydrocarbons up to four carbon atoms into practical motor fuel is a conservation measure worthy of the attention of the combined industries.

The total yield of motor fuel or blending fluid from a given quantity of raw "wet" natural gas should easily be doubled by the application of efficient polymerization methods, without reducing appreciably the amount of gas available as such for the customary outlets of domestic and industrial consumption. The octane number of the total production should be improved considerably. The volatility of the blended natural and polymerized gasolines may be whatever the operator may wish, within reasonable bounds. In fact, by properly controlling both polymerization, about which much must yet be learned, and fractionation, with which the operator is already past master, the volatility may be made more practical, may be controlled to meet automotive needs and blenders' requirements with greater exactness and flexibility than is now the case.

By so controlling octane number and volatility, by producing a blending material more praccable even than present natural gasolines, the gasoline manufacturer may make his product as indispensable to the refiner as it has ever been, offsetting the possible disadvantage of polymerization to him. Certainly the refiner can produce volatility galore, if he chooses. His prime consideration at present is to increase his total gasoline yield per barrel of crude, to stop another loss which has been until recently unstoppable, and to increase the octane rating of his product at the lowest possible cost.

In the final analysis, the market and the extent of outlet for the natural gasoline manufacturer will depend on the relative price-quality ratio of his product, as compared to the amounts and qualities of product which the refiner can make for himself. That situation has always obtained, and will continue to do so indefinitely. As matters develop, it may become more profitable for the gasoline operator to supply heavier-than methane material via pipeline to the refiner for polymerization than to polymerize this material himself. In any case, an outlet for a waste product will be supplied which now exists in only very small ratio to the amount of this material available.

Gets Gusher Four Miles From Edge of Fitts

TULSA, Nov. 16. — A new well, brought in some four miles from the eastern edge of the present Fitts pool production in Pontotoc county, with a flow of more than 400 barrels an hour when it was shut in, topped the current news of the week in this area.

The well was a wildcat test by the Continental Oil Co., the No. 1 McCarty in the southeast corner of the northwest of 12-1-7e, near Jesse, in the southeastern corner of the county.

The drill apparently scratched the lower McLish sand at 4610 feet, and the well flowed open over the derrick for 30 minutes, then flowed by heads. It was deepened to 4633 feet when it flowed at the rate of 265 barrels in 36 minutes, when it was shut in, for more tankage and a pipeline connection being run in by the Stanolind Pipe Line Co.

Latest report was that the company was going to drill deeper into the McLish, and might go on to the Wilcox. Should the production increase as a result of this deeper drilling to the Wilcox, a condition that apparently is likely to happen in view of the behavior of the E. H. Moore No. 1 Atkins in the Fitts pool, the Continental well could become, according to some operators, one of the largest completions in the state. The E. H. Moore No. 1 Atkins is the only well that has been drilled on through the McLish to the Wilcox. The Continental well was making approximately 9,000,000 feet of gas when shut in. The fact that the 9-inch casing was set to 3914 feet, with no 6-inch having been set below that level, probably has held down the flow, according to some oil men. With the gas pressure in the well, a flow through a section of 6-inch casing, it was said, probably would have stepped up the flow considerably.

The Texas Co., the only company besides Continental, to hold acreage in the discovery well's section, will drill a test two locations southwest of the producer.

One of the most interesting developments of the week in Kansas has been the continued push westward. Locations were reported made the past week for wells in Gove county, the third county west of Russell county.

Anglo-Iranian Builds Six New Tankers

LONDON—A new program of tanker construction has been inaugurated by the Anglo-Iranian Oil Co., Ltd. Orders have been placed at British yards for six motor-driven tankers, each designed to carry about 12,250 tons deadweight.

The new tankers, which will be the largest in the fleet, will have an overall length of about 480 feet. Provision has been made for carrying three isolated "parcels" of cargo in 27 separate compartments. Four pumps are provided with a view to permitting the carriage of even more than three grades of oil without risk of contamination.

The propelling machinery, installed at the after end, will drive a single screw, giving an average service speed of about 12 knots.

New Chairman

NEW YORK—C. A. Daniels, Phillips Petroleum Co., Borger, Texas, has been appointed chairman of the American Petroleum Institute's division of production in the Mid-Continent district to succeed J. C. Johnston, Continental Oil Co., Borger. Mr. Johnston has been transferred to the southwestern district.

Standardization and Simplification Will Cut Automotive Service Costs

Presented before American Petroleum Institute under the title "Trends in Automotive Servicing" at annual meeting Los Angeles, Nov. 11-14, 1935.

By D. G. Coombs* and L. B. Veeder*

Ease and simplicity in servicing automobiles has been neglected by automobile manufacturers in favor of cost and styling and, at the same time, the trend in the operation of the oil companies' service stations has been to emphasize servicing because of the drop in the amount of gasoline business to the station, as the number of stations has greatly increased.

The authors of the accompanying paper presented at the American Petroleum Institute meeting at Los Angeles suggest that a committee of practical men from the marketing branch of the oil industry work with the designing engineers of the automobile industry to simplify the servicing features of the cars of the future.

They suggest further the simplification and standardization of such service points as crankcase drain plugs and transmission and differential housing plugs; steering gear housing; crankcase fill pipe and gas tank fill pipe; location of the battery and so on. It is pointed out that this would greatly simplify the servicing of cars without interfering with individual styling or efficiency.

The statement is made that, since 1931, some 40,000 lifts have been installed in gasoline resale outlets, with specialized lubrication equipment and necessary tools, in the effort by the oil industry to facilitate and improve its servicing of cars.

In spite of this, if the cost of servicing cars is to be reduced, these authors believe the car manufacturers must reduce in number and make more accessible the service points and also consider the standardization of these points.

INFLUENCED, no doubt, by the present-day "streamlined" trend for speed, an insistent query has been developed in connection with automotive servicing, viz.: "How long will it take?" This question is coming in increasing volume not only from the motoring public but from our marketing executives. The answer to that question determines in a large part, on one hand, whether a sale is made; on the other, a profit.

The oil companies have attempted to satisfy this increasing demand for speed insofar as gasoline service is concerned by providing wider service-station driveways, more conveniently arranged facilities, faster and more accurate power-driven dispensing equipment, more flexible delivery hose, larger capacity nozzles and, even more recently, computing pumps that eliminate any necessity for mental arithmetic in computing the cost of the gasoline dispensed to the customer. This has all been developed to satisfy the never-ending public demand for speed and service in this so-called "streamlined" age.

Modern Service

Not content with this recognized demand for faster service in connection with both lubrication and gasoline, we find the demand extended to greater refinements in service, a more thorough, painstaking lubrication job, and additional comfort facilities such as modern heated waiting and rest rooms—all at no increased cost to the customer. This has been an insidious growth, and we now find ourselves including all of these services on the basis of lower average price levels than previously existed in the industry a relatively few years ago. Admittedly, the motoring public cannot be blamed for all of the increase in this costly service burden, as certain of these plant and equipment changes have been inaugurated by the oil companies in an attempt to conserve man-hours and possibly as a competitive measure.

"Super" Trends

Faced, then, with a continuation of the present "streamlined" trends in automotive body design, with the added requirement of more expert and thorough lubrication service requirements, where are these trends leading us insofar as they affect cost and volume at the service station? How long can the marketing branch of the industry continue this "super" service at present price levels in the face of an increasing hourly labor cost, added taxes, and the capital investment involved in providing more modern service facilities? Let us then consider certain

*Shell Petroleum Corp., St. Louis, Mo.

trends as indicated by published data on automobile registration, industry consumption, number of service stations. automobiles (customers per station), and average gasoline consumption.

Year	—1— Automotive Registration	—2— Industry Consumption (Gallons)	—3— Filling Stations	Automobiles Per Station
1928.....	24,493,124	13,945,000,000	190,000	130
1929.....	26,501,443	16,000,000,000	202,000	131
1930.....	26,545,281	16,581,000,000	236,000	112
1931.....	25,832,884	16,943,000,000	258,000	100
1932.....	24,115,129	15,203,000,000	269,000	89
1933.....	23,843,591	15,436,000,000	272,000	87

Year	—4— Consumption Less 10 Per Cent (Gallons)	—5— Monthly Av. Consumption Per Station (Gallons)	Daily Average Per Station (Gallons)	—6— Daily Average Consumption (Gallons)
1928.....	13,805,550,000	6,100	200	37,820,000
1929.....	15,840,000,000	5,800	213	43,400,000
1930.....	16,415,190,000	5,800	190	45,000,000
1931.....	16,773,570,000	5,400	177	46,000,000
1932.....	15,545,970,000	4,800	157	42,600,000
1933.....	15,281,640,000	4,600	150	41,900,000

1—Figures from American Automobile Association.

2—Figures from U. S. Bureau of Mines.

3—Figures from Cole Committee Report on Marketing Activities—House Resolution 441.

4—Consumption figures in column (2) have been reduced by 10 per cent to allow for tank-car and tank-wagon purchases of gasoline to commercial consumers, such gasoline not going through "filling stations."

5—Monthly average consumption per station based on "consumption less 10 per cent."

6—Daily average consumption based on consumption less 10 per cent."

NOTE: The figures in column (3) are only representative of "drive-in" service stations and garages, where the sale of gasoline is a major item. These figures do not include such outlets as rural general stores, hardware stores, road houses, and the many other merchandising establishments selling gasoline. While this type of re-sale outlet has increased in number, no authentic figures are available. We shall, therefore, consider "consumption less 10 per cent" as passing through only the filling stations shown in column (3). It must be borne in mind that such figures as are shown in the columns headed "automobiles per station," "monthly average consumption," and "daily average per station" are much higher than actual.

It is recognized that certain assumptions have to be made when utilizing statistics as comprehensive as those just given. Especially is it true when the desired information has to be extracted from a combination of figures and data gathered from various sources. In other words, there are certain inherent difficulties in combining statistics gathered from several sources into one logical and related result. We believe, however, that the approximations and averages are sufficiently accurate to serve the purpose of this discussion, and to indicate certain definite trends that have an effect on the problems of service-station management.

Over-built

Making due allowances, then, for certain assumptions, it is probably not far afield to state that, insofar as the economical distribution of gasoline outlets is concerned, the petroleum industry is some 40 to 60 per cent over-built. Further dilution of the gasoline gallonage per unit will automatically force many of these retail outlets out of business; and those that survive will, on the whole, have to be content with lessened volume. As an indication of this trend, we find the average monthly throughput per station in 1924 was 6,100 gal.; in 1933 this had dropped to an average of 4,600 gal. per unit, a decrease of 24 per cent. In the same period the number of service stations increased 45 per cent. From 1928 to 1933, automotive vehicles per station decreased 33 per cent.

In order to supplement revenue to compensate as far as possible the loss of gasoline volume due to these competitive conditions, the merchandising of products and services "below the gasoline line" has become a marked factor in the petroleum industry's marketing program at retail outlets. This competitive condition has been a constant influencing factor in dealers' requests for additional facilities and equipment as an essential adjunct to his diminishing gasoline volume.

Lifts

With the introduction of the present "streamlined" type of automobile some few years ago, with its marked movement towards speed, safety, and comfort—specialized lubrication came into the picture as an increasingly important factor, as the maintenance of this new type of automobile was sharply focused both upon the number and kind of lubricants as well as the method of application. This, of necessity, required special equipment to meet these special needs, both as to application and lubricant—which, in turn, has been reflected in an increased investment per station.

In 1927, the first year of active lift or hoist installation, some 1,500 lifts were purchased. In 1931 this number increased to a peak of 12,150. In 1934, 7,750 lifts were installed. From figures taken from a survey source that we regard as most reliable, it is estimated that there are at present over 50,000 lifts in operation at resale gasoline stations. The installation data which follows is restricted to manufacturers or their successors at present in business.

At the end of 1927, approximately 1,500 lifts were in service.

During 1928 approximately 1,550 lifts were installed

During 1929 approximately 3,100 lifts were installed

During 1930 approximately 6,250 lifts were installed

During 1931 approximately 12,150 lifts were installed

During 1932 approximately 6,750 lifts were installed

During 1933 approximately 5,500 lifts were installed

During 1934 approximately 7,750 lifts were installed

During 1935 approximately 9,000 lifts (estimated)

The cost of a typical lift installation runs on an average from $400 to $600 and upward, depending upon the type of lift and the installation costs, including concrete platforms, etc. Here again is another heavy investment which most marketers claim is today an essential part of station equipment. With the installation of the lift or hoist comes the cost of specialized lubricating equipment which runs from $250 per station up, depending upon the type and amount of equipment purchased.

With the annual changes in automotive design, and the demand for speedy service on the

SINCLAIR INDEXED LUBRICATION CHARTS FOR THE NEW 1936 CARS

Sinclair engineers are preparing specialized lubrication charts for every car displayed at the 1936 Automobile Shows. These up-to-the-minute charts are Sinclair dealer guides to correct lubrication of every 1936 model—guides, also, to increased lubrication sales and more profits.

Charts for all models of all cars, new and old, are included in the Sinclair Lubrication Index—the only lubricating guide which quotes car manufacturers' recommendations as well as showing how to comply with them.

Sinclair engineers constantly cooperate with car manufacturers in developing approved lubrication charts. This cooperation by Sinclair is just one of the reasons why the Sinclair franchise is so valuable to distributors, jobbers and dealers. Get full details by writing to Sinclair Refining Company (Inc.), 630 Fifth Avenue, New York, N. Y.

SCENE at a municipal parking space. How much do 1936 cars differ from these of former years? Sinclair engineers are preparing individualized lubrication charts for every make of car shown at the 1936 Automobile Shows.

SINCLAIR

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SINCLAIR ENGINEER inspecting new ultra-streamlined "Scarab" built by Stout Engineering Laboratories, prior to charting its lubrication.

part of the customer, chassis lubrication has become more specialized than ever in lubricants, methods, and equipment. A service station which has kept up-to-date in its adoption and purchase of the new types of specialized equipment as additions to the original standard set will have expended, in the past 2½ years, approximately $52 for the new equipment. And we are speaking now of an *average* installation with all the equipment portable.

Lubrication Equipment

In 1926 the general set of lubrication equipment included:

1 Hand lever-operated grease gun.
1 Filler bucket.
1 Handy spray gun for springs.
1 Set of end wrenches.
1 Set of socket wrenches.

In 1935 the following is a minimum set of portable specialized lubrication equipment:

1 Lubrication manual.
2 Leatherette holders.
1 Sales work board.
1 Lubrication service sign.
1 3-ft. x 8-ft. lubrication standard.
1 Spring lubricant tank and spray gun.
1 Specialized service stand.
2 Power grease guns.
6 Hand grease guns.
1 10-ton booster.
1 Gripper wrench.
1 5-in-1 tool wrench.
2 Wire brushes.
3 Hudson-Essex drain plug wrenches.
1 Nok-in-tool.
1 30-in. shackle bar.
1 Ball pin hammer.
1 Super-service wrench.
1 14-in. screw driver.
1 Set protect-a-car covers.
1 Gear Flusher.
1 Auto vacuum cleaner.
2 Drive tools for Zerk fittings.
1 Multiplex box wrench.
1 10-in. crescent adjustable wrench.
2 Nozzles and filters.
1 "Speed" coupler.
1 Tire inflator with adapter.
1 25-ft. length ¼-in. air hose.
1 Pair 8-inch offset pliers.
3 Squirt oil spouts.
1 Shell spring lubricating tip.
1 Special chisel for spring lubrication.
1 Jack (extension model) for raising weight of car from springs.
1 Lubricator for covered springs.
1 Set end wrenches.
1 Set socket wrenches.

Since 1931 some 40,000 lifts (automotive hoists) have been installed at gasoline re-sale outlets of varying potentials, and these installations have required specialized lubrication equipment and the necessary tools in order to attract and retain the lubrication business of their gasoline customers—basing their service, in varying degrees, upon the individual motor-car manufacturers' recommendations.

While, undoubtedly, the possible potentials for such necessary and regular lubrication service, based upon the motor-car manufacturer's recommendations, have been reached at very few stations, nevertheless, the widespread introduction of these improved types of lubrication equipment at an increasing number of potential points for service makes this attainment daily more difficult. This drive for "below the line" revenue, particularly lubrication, is forcing us to a type of competition which, as in gasoline, cannot but lead to a similar dilution of lubrication volume, to the point where it will be distinctly unprofitable to maintain and operate such equipment at a large percentage of our re-sale outlets.

We are already faced with certain inevitable results of the trends enumerated above in the form of "cut-price" competition, combination grease-and-wash jobs, grease jobs as a premium with certain other purchases; and, as is so often the case with this type of competition, the service rendered often strays far afield from the motor-car manufacturer's recommendations. The car of today, if properly lubricated, requires a certain definite number of man-hours. These man-hours are influenced, to some extent, by the kind and type of equipment provided for this specialized lubrication service. Proper equipment, correct lubricants, and a decent hourly wage fix the essential costs of an individual lubrication job. If the volume of lubrication business at an individual station is not sufficient to carry the investment of facilities and equipment, the actual man-hours, and lubricants used on the job, the alternative is obvious, viz., increased revenue either through price adjustment or reduced costs. Increased volume is, in our highly-competitive market, a factor of location, advertising, and service—and any other reduction in costs may be said to be limited to: cheapening the job, i.e., "high-spotting" it; using improper or inferior lubricants; and/or a reduction in wages. All three are vicious, and have no place in modern merchandising methods. The most logical remaining costs to attack are those of equipment and man-hours. Simplification of equipment, i.e., a reduction in the investment required to properly service a unit, and/or a less complicated lubrication requirement, by which we mean fewer number of points to service and those points more accessible. These alternatives directly affect your man-hour costs. We will purposely refrain from any comment on the number and type of lubricants required, as we feel this is in capable hands—being a function of the Society of Automotive Engineers, the American Society for Testing Materials, and the automotive committee of the American Petroleum Institute.

Courtesy Service

We have included certain obvious competitive trends. Now let us analyze some of the service trends that are adding appreciably to our costs and man-hours required for a satisfactory and conscientious job.

To hold the present volume of profitable lubrication business and at least maintain the present price levels, which unfortunately have been downward and possibly aggravated by cer-

tain automotive dealers with their "contract system of lubrication" sold with the car, more and more courtesy services apparently essential to comfortable and satisfactory motoring have been introduced and stressed to the customer. Modern-service station merchandising attempts to show the customer the visible results of the personal efforts of the salesman to serve him. For example, the average specialized-lubrication job requires from 45 to 90 minutes, if thoroughly performed, and approximately 60 per cent of this time is spent in the so-called "courtesy" services such as:

	Average Time for Service (Minutes)
1. Placing covers over the fenders, clean steering wheel, shift and hand-break levers	1½
2. Flushing kerosine in differential transmission in free-wheel units before re-filling	10
3. Using special materials on the body hardware so that there will be no danger of soiling the customer's clothes	3
4. Vacuum cleaning the floor and upholstery of the body	10
5. Removing surface spots from the upholstery	2½
6. Removing all grease and oil spots from body	1
7. Checking the battery, tires, and lights for proper operating conditions	5
8. Cleaning the windows, windshield, inside and out	7
9. Wiping off the entire exterior surface of the car with a polishing cloth	10
10. Polishing the chromium plate	5
11. Rubbing the tires and running boards with a quick-drying lacquer paste	5

If all, or most, of these services are thoroughly and conscientiously performed, it adds a total of 30 to 50 minutes' time to the standard so-called "specialized" lubrication job at a labor cost of from 35 to 60 cents, depending upon the wage scale paid.

The old "grease ball" is gone. In his place we have a lubrication salesman. With constant introduction of new automobile models and the equipment necessary to service them, perpetual field supervision and training schools must be maintained if the service-station salesmen are to be able properly and efficiently to service all makes and models of cars, so that the customers may secure the maximum service from their car investment and remain satisfied patrons for all products and services offered at the re-sale outlet.

Service Standards

As a suggestion of what might be accomplished towards simplification and standardization of service points, we have set down certain recommended service standards which we feel would be a very definite step along economic lines without interfering with the individual styling or efficiency of the various makes of automobiles.

1. Crankcase Drain Plugs:

These should be located at the bottom of the pan at the lowest point, and the pan should be so constructed as to permit complete draining of the crankcase. Recommended size—¾-in. pipe thread with square head for 9/16-in. square wrench.

2. Transmission:

Both drain plug and fill plug should be of the same size as that in the crankcase. Recommended—¾-in. pipe thread, with square head for a 9/16-in. square wrench. Drain plug should be located at the lowest point.

3. Differential:

Both drain and fill plugs should be provided, and should be the same size as that of the crankcase and transmission. Drain plug should be located at the lowest possible point.

4. Steering-Gear Housing:

Present fill plugs are much too small to permit easy and proper filling of this unit. Recommended same size fill plug as those preceding.

A drain plug is also recommended in the steering housing, and if possible the same size to permit easy draining and flushing whenever necessary.

5. Clutch-Release Bearing:

This service fitting should be located under the hood—preferably on the right side, regardless of the type of lubricant used. A car should never be serviced with a grease gun or oil can inside the body proper—from a cleanliness standpoint. Floor boards should not be removed, nor should housing plates be taken off in order to lubricate this bearing. Not only is the time element involved, but foreign particles are likely to drop into the housing.

6. Crankcase Oil-Fill Pipe:

This should be located on the left side under the hood. The pipe should be sufficiently long to be free from obstruction; and the diameter should not be less than 2 in. at the breather cap, in order to avoid spilling oil and give rapid service. Majority preference is for a bayonet gage with uniform markings specifying various levels in quarts. If screens are provided in fill pipes, they should be removable for cleaning.

7. Gas-Tank Fill Caps:

These should be located on the left side of the gas tank of car for easy filling, regardless of trunk racks and streamlining. Fill pipes, where practical, should enter the top of the tank rather than the side—and special attention given construction to permit, as far as possible, an estimate of the gas level by the operator, in order to prevent spilling and over-running of the tank with attendant fire hazard.

8. Battery:

This should be located on the left side under the front floor board. Access should be through a trap in the flooring large enough properly to inspect both battery terminals and water level in the cells. Opening in the floor should be large enough to permit ready removal of the battery without moving the floor boards.

9. Lubrication Fittingss

a. Accessibility—

Fittings should be located so as to permit easy

Note: Reference has been made to location of various units on the left side of the car. Normal service is given to an automobile at the right side of a pump island or to the left side of a car against the pump island.

access with regular hand- and power-gun adapters.

b. Type of Fittings—

Lubrication fittings should be limited to a minimum of types, which can be serviced with power and hand guns with standard universal tips or adapters or a pressure oil can. The only angles which should be necessary are 45-deg. and 90-deg. angles, with preference for straight connection where practical. As far as possible, all fittings should be uniform on each make of car.

c. Welch Plugs and Drive-in Fittings—

Pressed-in Welch plugs and drive-in fittings should be eliminated as fast as possible. Experience to date indicates that, even under normal service and wear, such plugs and fittings are apt to become loose and blow out—resulting in improper lubrication of parts, as well as permitting dirt, grit, etc., to work into the bearings. The screw-in or thread-type is preferable, and should be used wherever possible.

10. Radiator Fill:

As long as streamlining and appearance are leading factors, the location of the radiator fill will be under the hood. So located, it should be on the left side, with easy access, easy to remove, and so constructed as to permit accurate checking of the anti-freeze solution.

11. Radiator Drain Cock:

This should be $^{3}/_{8}$-in. (minimum) lever-type thread drain cock located on the left side, in order to permit speedy and easy draining and flushing.

12. Wheels:

a. Lugs—

There should be one size wheel lug for passenger cars and trucks under two tons, in order to cut down the number of wrenches needed for servicing.

b. Valve Stems—

Due to the increase in the size of the hub and the decrease in the diameter of the wheel, it is becoming increasingly difficult rapidly to service or fill tires with air with the present straight valve stem; offset or rubber valve stems will seemingly solve this problem.

13. Spark Plugs:

At present, we require five different wrenches to give spark-plug service at class "A" stations. We feel that this number can be reduced to a much lower minimum. We also recommend a standard thread.

14. Spring Covers:

It is recommended that all spring covers be provided with openings or fittings, in order to permit the application of the lubricant.

These recommendations were approved by the Institute's Committee on Marketing Equipment at the mid-year meeting at Tulsa, Okla., May 15, 1935.

Other Service Time

In addition to these points, there have been very marked cases where apparently time and accessibility of service have not been considered in the location and/or construction of certain parts. The following examples are applicable to 1934 and 1935 models of several popular makes of cars.

	Average Time on Service (Minutes)
1. Clutch-release bearing located in the clutch-pan housing, underneath the car, requiring removal of the clutch pan to service	30
2. Clutch-release bearing located under floor board, and requiring removal and replacement of the floor board and the bolts and screws involved	30
3. Clutch-release bearing located under the floor board, and requiring the removal of screws and plate	30
4. Location and type of rear-wheel bearing fittings so that on a drive-on lift, unless the rear wheels were exactly spaced from the inner flanges, only one fitting could be reached without moving the car off and onto the lift for proper position with an ordinary hand gun	5
5. Battery located under the seat in a metal box with a vapor-proof cover that has to be *bolted on*	15
6. The battery is located under the seat. It has to be pushed up from underneath the car and then fastened	30

If we accept the premise that profits on lubrication service at the average service station is dependent upon reduction in labor and equipment costs, it is obvious that the petroleum industry must have a better and more intimate contact with the motor-car manufacturer. We feel that the petroleum industry must assume its share of responsibility of the present trends and complications involved in the servicing of the present-day automobile. We have, apparently, permitted each individual car manufacturer to complicate the service requirements as regards inaccessibility and number and type of service and lubrication points, and entirely neglected the possibility of standardization of those most vital service points.

We are also quite cognizant of the pressure brought to bear on the designing and engineering staffs of the automobile companies, from both the cost and style angle, which probably is responsible for placing accessibility and ease of servicing more or less in the background. If this situation is to be reversed, it will require active and concerted effort on the part of the marketing section of the oil industry. We stress the marketing section because, in the past several years, we think there has been a very definite and valuable cooperation between the petroleum and automotive industries along technical lines, proper use and type of lubricants, etc. But, apparently, the ease and simplicity of servicing has been more or less neglected in favor of cost and styling. It is the hope, then, that this paper will be of some influence in changing this viewpoint. Obviously, the first move is the responsibility of the petroleum industry; and it is our suggestion that a fact-finding committee of practical operating men from the marketing section of the oil industry be appointed to sit in with the designing engineers of the automobile industry to the end that the problems of both may be better understood.

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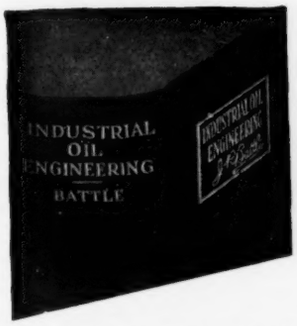

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Recent Flurry Shows California Fields No Menace to Eastern Markets

Presented before Sixteenth Annual Meeting, American Petroleum Institute, Los Angeles, Nov. 11-14, 1935.

By A. L. Weil*

DURING the period of time when there was no mandatory provisions upon the statutes requiring either curtailment or proration, the oil producers of California got together and voluntarily curtailed their production and prorated the allowable.

As soon as the statute was put upon the books and as soon as that duty became mandatory, it was only with the utmost of difficulty that the standard of production and the proration schedule theretofore put into effect could be maintained.

During the period of 1934, when you gentlemen east of the Rocky Mountains were struggling with a tremendously demoralized market, the market in California had been stabilized to a degree and a retail price of gasoline maintained which made it possible to bring in gasoline produced from hot oil in Texas, all the way from the Gulf, on tankers, pay the canal tolls, undersell gasoline in the State of California, and yield a small profit to the purchaser.

As soon as you gentlemen, or some of you, through your intelligent and herculean efforts, in the Mid-Continent, on the Atlantic Coast, succeeded in stabilizing production, in stabilizing the market for gasoline, California burst out in a perfect orgy of over-production and a perfect orgy of price-cutting which, in many instances, resulted in the sale of gasoline at less than the cost of production.

I think this last episode of ours caused a great deal of unrest on the Atlantic Coast, if we may judge from the telephone and telegraph messages with which we were deluged out here. You all seem to be in the condition of a resident on the Carribbean Sea who had seen the announcement of the approach of a hurricane, and you sit in your homes with fear and trembling, waiting for the blasts of wind and floods of water to overwhelm you. The days for the approaching hurricane came and went, and there were no blasts of air and there were no floods of water, and everything remained about the same as it was before.

The trouble with all this, and the reason for it was, that I think the producers in California overplayed their hands a little bit in this last outburst. They had succeeded in convincing the other producers in the State of California and, I think, succeeded in convincing each other and, in any event, had, to some degree, succeeded in convincing you gentlemen from the area east of the Rocky Mountains that the potential production of this state was something between 1,100,000 and 1,500,000 barrels a day.

These producers sat down in the game, and they only had a pair of deuces in their hands. But none of the other players knew it. As a matter of fact, I think they were somewhat myopic, and the deuces looked like aces, because, without having their hands called, they threw the hand down on the table, and it at once appeared that all it was, was a pair of deuces.

To take for an illustration, the famous Signal Hill Field, with the reputed potential of 125,000 barrels of oil a day, has been running wide open for weeks, and the maximum production that it has been able to make is somewhere around 76,000 or 77,000 barrels a day. The other Los Angeles Basin fields of Playa del Rey, Santa Fe Springs, Huntington Beach, will show somewhat similar results, although not quite to such an extreme degree.

If I may be permitted to impose upon your attention for a few minutes, I would like to quote to you a few statistics, comparing the existing situation with that which existed last time you were here, ten years ago.

In 1925, the total production of California for the year was 635,000 barrels a day. The total production for the year of 1935 was approximately 635,000 barrels a day, although in the last week or two the production has mounted quite considerably. I believe the production last week was 683,000 barrels a day. However, the production in 1935 was substantially equal to the production in 1925.

In the meantime, we have reduced our storage 37,000,000 barrels. The consumption of gasoline here has gone from 1,100,000,000 gallons in 1925 to 2,100,000,000 gallons in 1935. We have increased our off-shore shipments from 71,000 barrels a day in 1925 to 114,000 barrels a day in 1935.

The interesting feature of the whole thing, which I am sure you gentlemen will receive with approval, is that during the same year period the sales of California production to the Atlantic Coast decreased from 78,000 barrels a day to 48,000 barrels a day. In other words, the production is substantially

*President, General Petroleum Corp.

the same, the storage is extraordinarily lower, and our local consumption has almost doubled.

I doubt very much if there is any serious menace in the California oil situation to the Atlantic Coast, which will interest the producers and refiners there, and the producers and refiners in the Mid-Continent and Gulf Coast who look to the Atlantic Coast for a market.

To further illustrate the unusualness of the California situation, we have here what might be aptly designated as two types of fields. There are the Los Angeles Basin fields, and there are San Joaquin Valley fields.

In the Los Angeles Basin fields, taking Signal Hill again, as a typical example, the ownerships are very small. I believe one piece of property in the Santa Fe Springs field, for example, is about 60 feet wide and about 200 feet long, and contains five producing wells.

Any of you who have been in the Santa Fe Springs field are very familiar there with Hell's Half Acre. The men who operate these fields are, to a considerable extent, not oil men at all. They are men who have been attracted to the oil industry from other walks of life by the promises of a quick and easy profit at their very doors. They have gone into these markets; they have no interest in the future of the oil industry; they have no interest in stabilization; they have no interest in conservation. All they want is to get the greatest amount of money in the shortest possible time.

These fields are almost within the confines of the City of Los Angeles, which is the largest consuming area west of the Rockies. Crude oil and refined products can be trucked over the good roads and no grades at a minimum of expense. Here you would expect that you have an ideal situation to demoralize and upset a market.

As the conditions now exist, these particular fields that are in the worst possible situation from an oil man's point of view, are not disturbing the market at all. On the other hand, we have fields in the San Joaquin Valley that are just the opposite in their physical and ownership characteristics to those in the Los Angeles Basin. I am speaking particularly of the Kettleman North Dome.

The Kettleman North Dome, as you all know, is one of the very famous fields of the world. The property up there is all owned in large parcels. The wells are all being drilled on a twenty-acre spacing agreement. The properties are all owned and controlled by strong people, by men whose future is bound up with the future prosperity of the oil business, by men who know what the unreasonable waste of reservoir energy by blowing gas into the air will do to the oil field, and by men who know the damage that will be done by the infiltration of water when no back pressure is put upon the well.

HERE obviously is a field which should be a leader in the conservation movement, a field that should be a leader in stabilizing the oil industry. You gentlemen who are not already familiar with the facts may be surprised to learn that it is the bad example of overproduction, set in this field, circumstanced as it is and held in strong and powerful ownership, that is preventing a proper degree of stabilization and orderliness in the oil industry in California today.

(Applause)

The unfortunate part of the whole business is that the whole situation could be controlled by not more than five men. In most of these other fields where you have trouble, the Los Angeles Basin fields on the one hand or your fields in East Texas on the other, you have hundreds and hundreds of operators to deal with.

One man has one idea and another has another, and even when they have honest intentions and are trying to accomplish a result, there is such a diversity of opinion as to how the results shall be accomplished that it is almost impossible to obtain unity of action.

If five men, at most, who are interested in the Kettleman fields, would sit down together and forget their personal animosities and their megalomania, their desire to be big shots in the oil industry, this whole situation could be cleared up in a single noon-day session.

It therefore appears to me, gentlemen, that this is a situation which should not endure for a very long time. I cannot believe that experienced oil men, men who know what they are about, whose interest is ultimately tied up with the oil industry, should sit there for any considerable length of time and gut one of the greatest oil fields in the world today.

In reference to legislation, I feel that California cannot hold out much promise at the moment. I think that most of the oil men in California are strongly behind the interstate compact, and will use every effort within their power to bring about the accession of California to this compact.

We have a bad legislative history in California. It is true we have two pretty good statutes here. We have one statute which prohibits the drilling of wells within 150 miles of the boundary of a property, which will probably prevent conditions that would permit a new town lot development which would be disastrous to the industry. We have another statute that prohibits the blowing of gas into the air, and if this statute is intelligently and vigorously enforced by the state, it will do very much to bring about curtailment in itself.

As far as controlling production is concerned, in the sense of having some commission fix the market demand for crude oil and then allocate that demand amongst the fields and properties of the state, I feel that is temporarily a hopeless situation.

A few years ago, the bill that has gotten a rather malodorous reputation and is known as the Sharkey Bill, was passed by the California legislature. In my opinion, that was a good bill. That bill had the great quality that it did not place the administration in the hands of any political or bureaucratic appointees. The commission that

was to administer that bill was chosen by the oil industry itself. I know that is a difficult situation to accomplish, but in my judgment it is an ideal situation.

If we can keep the control of the oil industry in the oil industry, we have gone a big step in advance over anything that has been otherwise proposed. There was no possibility of the domination of the small producer by the integrated companies. The commission that was to administer this bill was elected by a vote of the oil operators. Each company had one vote for the representative of his district. A company with 20,000 barrels a day production had one vote for the commissioner, and a company with 20 barrels a day had one vote for the commissioner.

Nevertheless, that bill was taken out by the commission on a referendum and submitted to the people of California for their vote. A very intelligent campaign was waged against the passage of the bill, and the big argument that was put up, an argument that was unanswerable, was that it would for the time being at least increase the price of gasoline.

Of course, the purpose of all control measures of this sort, whether they be to control waste or what-not, is that the oil producer shall receive a fair price for his oil, which enables him to pay a fair scale of wages to his workmen and at the same time that the refiner and the marketer shall receive a fair profit for their branch of the business. And also that those interminable and constant price wars shall be eliminated.

Naturally, if we stabilize the price of gasoline and eliminate the price wars, the price of gasoline is bound to go up, at least temporarily. And that was the argument that was used to defeat the bill, because it was an argument which could not be answered.

The people of California are very gasoline price-conscious. You all know from the statistics the large per capita ownership of cars in this state. There is hardly a family that does not own at least one car. And when you take a few cents more a day per gallon out of the pockets of any of those car owners, they are not very seriously concerned about conservation or the future of the oil industry or the welfare of anybody else. They just figure out how many more dollars a month it will cost them to buy their gasoline, and they vote against the measure.

The bill was overwhelmingly defeated on this referendum. As I recall, the vote was something like four to one against the bill.

Most of the men in the oil industry who opposed the Sharkey Bill, I think now look back with some regret at their action. They feel we would all be much better off if we had some sort of a regulatory measure, even though it were not a perfect one. But there is a group in California here who have just about enough oil to say that they are in the oil industry, who for some reason of their own have decided that no such regulatory measures shall pass, or any similar regulatory measure.

And the members of the state legislature of California have been so terrorized by this popular uprising that struck down the Sharkey Bill, that I am very doubtful if within the next few years it will be possible to get any sort of legislation through, no matter how convincing the arguments may be that it is to the best interests of the state.

Shipments of Oil to Italy Against Government Policy Says Hull

WASHINGTON, Nov. 15

SHIPMENT of oil and other "war materials" from the United States to Italy is contrary to the government's policy, according to Secretary of State Hull in strongest language used to date by an administration official on the neutrality situation.

In a formal statement, Secretary Hull recalled how President Roosevelt on Oct. 5 warned Americans that they trade with Italy at their own risk. He called attention to his own statement Oct. 10 and to another statement by the President Oct. 30 reiterating this warning.

"The American people are entitled to know," said Hull, "that there are certain commodities such as oil, copper, trucks, tractors, scrap iron and scrap steel which are essential war materials, although not actually 'arms, ammunition or implements of war,' and that according to recent government trade reports a considerably increased amount of these is being exported for war purposes.

"This class of trade is directly contrary to the policy of this Government as announced in official statements of the President and Secretary of State, as it is also contrary to the general spirit of the recent neutrality act.

"The administration is closely observing the trend and volume of exports to those countries and within a few days the Department of Commerce expects to have complete detailed lists of all commodities exported to the belligerents which will enable exact comparison with lists for the same period last year."

Secretary Hull's statement was regarded by some as a virtual admission that the President under the Neutrality Act has not the power to declare oil an "implement of war" and embargo oil shipments to Italy and Ethiopia. It was also viewed as further indication that the administration will seek broader powers under the Neutrality Act as soon as Congress meets in January.

Hull's point about the administration watching shipments to the belligerents was taken as confirmation of reports that the administration is planning to make public the names of all exporters shipping to Italy and Ethiopia.

Treasury Ruling

(*Continued from page* 21)

reseller had no idea that he was going to sell to the governmenal agency (or for other tax-exempt purpose) when he purchased the article.

That is what the regulations provide. How it will work out in practice, is uncertain. It may be this way:

The refiner (manufacturer) pays the tax to the government on a tank car of gasoline he has sold to a jobber. He includes the tax in the price charged the jobber. The jobber in turn sells the gasoline to a dealer and passes the tax along. The dealer sells 100 gallons to the city for use in its fire engines.

The dealer's sale is entitled to tax-exemption. He gets the proper city authorities to sign an exemption certificate stating the purpose for which the gasoline will be used. The dealer would use an exemption certificate substantially the same as the form used in similar cases by the refiner (Form A, following this article).

Then the dealer makes out an affidavit (Form E) certifying that he has in his possession all of the exemption certificates required by the regulations. This affidavit, which also contains the dealer's consent to the manufacturer's obtaining the tax credit or refund, is passed on to the jobber who in turn gives it to the refiner.

The refiner uses the dealer's affidavit (and exemption certificate, perhaps,) to secure from the Internal Revenue Bureau a refund or credit for the amount of tax involved. The refiner obtains the credit or refund, then he credits or refunds a similar amount to the jobber. The jobber makes a similar allowance to the dealer.

The uncertainty about this procedure is what attitude the refiners will take. They may feel that the affidavit is insufficient protection and may require that the dealer file with them the exemption certificate itself. Again, the refiner may decide that he will treat only with the "ultimate vendor" who made the sale entitled to tax-exemption, and disregard the jobber and other intermediate resellers in the chain or sales.

The dealer or other reseller making the sale entitled to tax-exemption is required to retain the exemption certificate for four years and to furnish it to the refiner at any time within that period for use in establishing that a credit or refund is justly due.

Under the old law and regulations, the procedure was quite different.

Formerly, only the refiner or the jobber (the refiner's immediate vendee) could make a tax-exempt sale. Prior to or at the time of the sale, the jobber (or other reseller purchasing directly from the refiner) would supply the refiner with a sworn statement that the gasoline or oil was to be sold for an "essential governmental function." Within two months the jobber also had to furnish the refiner with proof that such a resale was made. If not, the refiner had to pay the tax; although he could claim a refund upon producing such proof at any time within four years.

THE old law and regulations made it necessary to know at the time of the first sale that the resale was to be for an "essential governmental function." Moreover, if there was more than one intermediate sale between the refiner and the State or political subdivision thereof purchasing, the sale could not be exempt from tax—even if it was known in advance that such a resale was to be made.

But this has been changed in the new law and regulations. The tenth reseller in a chain of sales from the refiner to the consumer may make a sale entitled to tax exemption and obtain a credit or refund, if the appropriate exemption certificates are obtained and the refiner supplied with certificate (or affidavit, if that is considered sufficient).

This part of the new law went into effect Oct. 1, 1935. Even if a sale by a manufacturer to a dealer or other reseller were made in August or September, apparently the dealer or reseller is entitled to obtain a tax credit or refund for the amount sold or used on or after Oct. 1 for an "exclusive" governmental use. Of course, he would have to obtain an exemption certificate and furnish an affidavit and/or the certificate to his refiner.

Incidentally, the Bureau, to discourage attempts at using the exemption certificates to evade payment of taxes due, has included in the certificates a warning that fraudulent use of the certificates may mean $10,000 fine and five years' imprisonment.

There are several ways, under the new regulations, of making a tax-free sale or claiming a tax credit or refund on a sale entitled to tax-exemption.

To make a tax-free sale, the manufacturer must have definite knowledge prior to or at the time of sale, that the gasoline or oil is purchased for the governmental unit's exclusive use. He must obtain from an authorized officer of the governmental unit and retain in his possession a properly executed exemption certificate. When this has been done, the manufacturer need not even take a credit in his return. He simply lists the sale under "non-taxable sales."

However, it is not always possible to obtain the exemption certificate at the time of sale. So, the new regulations provide that if the certificate is obtained after the sale but prior to the time the manufacturer is required to file a return (that is, on or before the last day of the month following the month in which the sale was made), he should include the tax on such sale in the item "total tax due" but he may deduct an equivalent amount from the tax paid, giving an explanation along with the return.

Should the manufacturer not obtain the certificate before the tax return is due, he must pay the tax. However, if the certificate is later obtained he may claim a refund (Form 843) or take a credit upon a subsequent return. But such action must be taken within four years.

The regulations require that the exemption certificates include an agreement that the purchaser will report to the manufacturer if any of the gasoline or oil is used for other than a tax-exempt purpose.

According to the regulations, the manufacturer on being so notified must pay tax on the gal-

lonage involved in his return for the month during which he received the report of the non-exempt use.

To protect himself against this tax liability, Willis Crane, in an analysis of the new regulations, suggests that the manufacturer may include in the exemption certificate or the sales contract a provision requiring the purchaser to indemnify the manufacturer against payment of tax on any gasoline or oil diverted from tax-exempt uses.

Like the old regulations, the new rules state that if it is impracticable to furnish an exemption certificate for each order, a certificate covering all orders between given dates will be accepted. However, such periods are now limited to a "calendar month."

Apparently, procedure for making tax-free sales or obtaining credits or refunds for sales in other classifications entitled to tax-exemption is the same as the procedure outlined above for sales for an "exclusive" governmental use.

However, the regulations apparently make Nov. 12, 1935, (effective date of the regulations) the effective date for the rules covering these sales for other kinds of tax-exempt uses. The rules covering sales for exclusive governmental uses, as stated above, were made effective as of Oct. 1, 1935 (effective date of the law) even though these rules also were not promulgated until Nov. 12.

On and after Nov. 12, 1935, no tax-free sale may be made to a dealer or other reseller for resale for any of the tax-exempt uses listed below. However, a manufacturer, in each instance, may make a tax-free sale by selling directly for such tax-exempt use.

Briefly, the other classes of sales which are entitled to tax-exemption (they are unchanged from the old law) are, as follows:

Sales of gasoline or lube oil for use by fishing or whaling vessels and certain other types of vessels as fuel supplies, ship stores, sea stores or legitimate equipment. This includes "all articles, materials, supplies and equipment necessary for the navigation, propulsion and upkeep of vessels" (see Form B).

Sales of benzol, benzene, naphtha and other liquids not commonly known as gasoline, for use otherwise than as motor fuel or the production of motor fuel.

Sales of oil for non-lubricating uses.

FORM A

EXEMPTION CERTIFICATE

(For Use by United States, States, Territories or Political Subdivisions Thereof, or the District of Columbia)

....., 193....
(Date)

The undersigned hereby certifies that he is the .....
(Title of Officer)

of .....
(United States, State, Territory, or Political Subdivision, or District of Columbia.)

and that he is authorized to execute this certificate, and that the article or articles specified in the accompanying order or on the reverse side hereof, are purchased from .....
(Name of Company)

for the exclusive use of .....
(Governmental unit)

of .....
(United States, State, Territory, or political Subdivision, or District of Columbia.)

It is understood that the exemption from tax in the case of sales of articles under this exemption certificate to the United States, States, etc.—is limited to the sale of articles purchased for their *exclusive use*, and it is agreed that if articles purchased tax-free under this exemption certificate are used otherwise or are sold to employees or others, such fact must be reported to the manufacturer of the article or articles covered by this certificate. It is also understood that the fraudulent use of this certificate to secure exemption will subject the undersigned and all guilty parties to a fine of not more than $10,000, or to imprisonment for not more than five years, or both, together with costs of prosecution.

.....
(Governmental Unit)

By.....(Signature)
(Title of Officer)

FORM B

EXEMPTION CERTIFICATE

(For use by purchasers of articles for use as fuel supplies, ships' stores, sea stores, or legitimate equipment on certain vessels, Section 630 of the Revenue Act of 1932).

....., 193.....
(Date)

The undersigned purchaser hereby certifies that he is .....
..... of....
(owner, officer, charterer or an authorized agent)

..... and
(Name of company and vessel)

that the article or articles specified in the accompanying order, or as specified below or on the reverse side hereof, will be used only for fuel supplies, ships' stores, sea stores or legitimate equipment on a vessel belonging to one of the following classes enumerated in Section 630 of the Revenue Act of 1932:

(Check Class to Which Vessel Belongs)

(1) Vessels engaged in foreign trade.

(2) Vessels engaged in trade between the Atlantic and Pacific ports of the United States.

(3) Vessels engaged in trade between the United States and any of its possessions.

(4) Vessels employed in the fisheries or whaling business.

(5) Vessels of war of the United States or a foreign nation.

The undersigned understands that if the article is used for any purpose other than as stated in this certificate, or is resold or otherwise disposed of, he must report such fact to the manufacturer. It is understood that this certificate may not be used in purchasing articles tax-free for use as fuel supplies, etc., for any type of aircraft or pleasure vessel. It is also understood that the fraudulent use of this certificate to secure exemption will subject the undersigned and all guilty parties to a penalty equivalent to the amount of tax due on the sale of the article and to a fine of not more than $10,000, or to imprisonment for not more than five years, or both, together with costs of prosecution. The undersigned also understands that he must be prepared to establish by satisfactory evidence the purpose for which the article was used.

(Name) .....

(Address) .....

FORM C

(For use by purchasers of benzol, benzene, naphtha, or other taxable liquid, for purposes other than as a fuel for the propulsion of motor vehicles, motor boats, or airplanes, and otherwise than in the manufacture or production of such fuel under section 617 (c) (2), as amended).

....., 193.....
(Date)

The undersigned purchaser hereby certifies that he is a .....
.....
(State business and article or articles manufactured.)

and that the .....
.....
(State whether benzol, benzene, naphtha, or other taxable liquid.)

..... in the order covered by this certificate will not be used as a fuel for the propulsion of motor vehicles, motor boats, or airplanes, and will not be used in the manufacture or production of such fuel, but will be used for the following purpose:

.....
.....
.....

The undersigned understands that if the benzol, benzene, naphtha, or other taxable liquid is used, sold, or otherwise disposed of except as above stated, he will be liable for the tax upon such use, sale, or other disposition of such product. It is understood that the fraudulent use of this certificate to secure exemption will subject the undersigned and all guilty parties to a fine of not more than $10,000, or to imprisonment for not more than five years, or both, together with costs

of prosecution. The undersigned also understands that he must be prepared to establish by competent evidence that the product was actually used for the purpose or purposes for which purchased as stated in this certificate.

.....
(Name)

.....
(Address)

FORM D

(For use by purchasers of oil for non-lubricating purposes.)

....., 193....
(Date)

The undersigned purchaser hereby certifies that he is a .....

.....
(State business and article or articles manufactured.)

and that the oil covered by the accompanying order or as specified on the reverse side hereof, will not be used or resold for lubrication but will be used by him for the following purposes:

.....
.....
.....

The undersigned understands that if the oil is used for any purpose other than as stated in this certificate, or is resold or otherwise disposed of, he must report such fact to the manufacturer, otherwise the privilege of purchasing tax-free may be canceled; that he will, if a bonded and registered manufacturer of lubricating oil, be liable for the tax upon his sale of such oil, and that whether or not a bonded and registered manufacturer, he will, for fraudulent use of the certificate to secure exemption, be subject to a penalty equivalent to the amount of tax due on the sale of the oil and to a fine of not more than $10,000, or imprisonment for not more than five years, or both, together with the costs of prosecution. The undersigned also understands that he must be prepared to establish by competent evidence the purpose for which such oil was used.

.....
(Name)

.....
(Address)

FORM E

AFFIDAVIT OF ULTIMATE VENDOR

....., being duly
(Name of individual)
sworn, deposes and says:

That he is the .....
(Title)
of the .....,
(Name of company)
or is himself the ultimate vendor of the articles specified below or on the reverse side hereof:

That the articles specified below were purchased by him tax-paid and resold for use by his vendee for the non-taxable purposes indicated and not for resale.

That he has in his possession all of the exemption certificates, properly executed, required by the law and regulations, to cover the sale of the articles specified herein.

That the certificates and supporting data (1) are retained by him, (2) will be preserved for a period of four years, and (3) will, upon request, be forwarded to the manufacturer any time within the period for use in establishing to the satisfaction of internal revenue officers that a refund or credit is justly due.

That he hereby consents to the allowance of a credit or refund to the ....., in
(Name and address of manufacturer)
the amount of the tax paid by such manufacturer, with respect to the sale of such article, and that he has not heretofore given his consent to the allowance of a credit or refund to any other manufacturer and has not made application for a refund or credit of such federal tax from any other source.

The undersigned understands that the fraudulent use of this affidavit to secure credit or refund will subject him and all guilty parties to a fine of not more than $10,000 or to imprisonment of not more than ten years, or both, under Section 35 of the Criminal Code of the United States, as amended by Act of Congress approved June 18, 1934. (Public No. 394, 73rd Congress).

NAME .....
ADDRESS .....
.....

Subscribed and sworn to before me this.....day of....., 193.....
.....

Vendor's Invoice	*Articles*	*Date of Re-sale*	*Quantity*	*Purpose or Use*	*Tax Claimed.*

New Canadian Trade Treaty Cuts Tariff on American Oils

WASHINGTON, Nov. 18

REDUCTION of the excise tax on imported lumber in the Canadian trade treaty signed Nov. 15 opens the way to a similar cut in oil import taxes in future reciprocal trade agreements, according to views expressed in oil circles today.

So far as the Canadian trade treaty goes, the American oil industry apparently has all to gain and nothing to lose—although the gains may not be very great.

The treaty calls for reduction in Canadian tariff duties on gasoline, kerosine, lubricating oils and certain other petroleum products exported from the United States. None of the concessions made by the United States to obtain these and other concessions from Canada affects the oil industry directly.

The special excise taxes on foreign oil coming into the U. S., sometimes called the oil "tariff", were left untouched. But the excise tax on imported lumber was reduced from $3 to $1.50 per thousand feet on Canadian lumber. This 50-per cent reduction in the "protection" given to the American lumber industry was viewed as an indication that the Roosevelt Administration, in negotiating a treaty with some oil-producing country—Mexico, for instance, might agree to reduce the tax on oil imported from that country.

Concessions made by Canada regarding import duties on oil from the United States were, as follows: illuminating oils over 30 cents a gallon, duty reduced from 20 to 17.5 per cent ad valorem; lubricating oils, less than 25 cents a gallon, reduced from 2.5 to 2.25 cents a gallon; crude petroleum, gas oils, except gasoline, between 0.8235 and 0.775 specific gravity, reduced from 1.5 to 1.25 cents per gallon; refined gasoline, kerosine, under 0.8235 specific gravity, reduced from 2.5 to 2.25 cents per gallon; lubricating oils not otherwise provided for, and axle grease, reduced from 20 to 17.5 per cent ad valorem; and petroleum preparations for toilet, medicinal use, etc., reduced from 25 to 22.5 per cent ad valorem.

As evidence of the effect of the treaty, the Administration pointed out that during the fiscal year 1930 (before the "discriminatory" duties were imposed by Canada) the value of the abovementioned petroleum products exported to Canada was $19,982,000. By the fiscal year 1935, these exports had fallen to $4,154,000.

Of interest also to the oil industry, was the reduction in the Canadian duty on American automobiles, trucks, buses, diesel engines and motorcycles. Canada lifted entirely the 35 per cent ad valorem duty on "oil-sands extracting machines and parts."

The United States bound itself, so far as Canada is concerned, to keep carbon black, lamp black, etc., on the "free list" of American imports.

Monday's marketing *can use more gasoline* than Sunday's trip

4 out of every 5 miles you drive *are stop-and-go*

Starting, Shifting and Accelerating waste money if your gasoline hasn't these 3 Different Kinds of Power

IT'S the *short* trips . . . to the grocer's, the meat market, the drug store, the bank, the department store . . . that eat up your gasoline!

This is easy to figure out when you consider that a short run from a "cold" start can use up a "mile" of gasoline . . . and that rapid accelerating can use 33% more gasoline than just rolling along on a straightaway!

To save yourself money on today's stop-and-go driving, you don't want a gasoline that merely STARTS quickly . . . or one that merely PULLS easily on hills . . . or one that merely gives good MILEAGE on long runs! One kind of power isn't enough!

What you really need is a gasoline that has *ALL THREE kinds of power* . . . Power for Starting —Pulling—Running. In short, you need a BALANCED gasoline!

Shell engineers now offer you the FIRST gasoline of this type . . . the FIRST truly balanced gasoline . . . especially made for today's stop-and-go driving.

Stop today at one of the 30,000 neighborly Shell stations from Coast to Coast. Fill up your tank with Super-Shell today and see for yourself how it can cut driving costs and save you money.

SAVES gasoline in 3 ways:

STARTING—This *balanced* Super-Shell can save up to a cupful of gasoline on every "cold" start. Even on sizzling days, your engine is relatively "cold" after it has stopped running.

PULLING—It can save up to a cupful in 10 minutes of rapid accelerating or hill climbing. And you avoid *knocking* which alone in a few minutes can waste 10% of your power.

RUNNING—Super-Shell can save up to a cupful, motorists report, in an hour on the long stretch—thus saving on long runs as well as on short trips.

Remember, when you save 16 cupfuls, you save a gallon!

Super-SHELL

Saves on today's stop-and-go driving

• MARKETS •

CLEVELAND, Nov. 18

WITH retail and wholesale gasoline prices working higher in the week ended Nov. 16, it became more and more apparent that the industry is not going to bear the brunt of low prices as it has done so many winters in the past.

Usually, at this time of year, offerings of gasoline have been in excess of demand with the result that prices have decreased to cost or below. Retail prices followed the reduction in wholesale prices, completely breaking down the price structure.

Due to several factors, there is little or no surplus gasoline available at present. As a result, both tank car and retail gasoline prices as reflected in the NATIONAL PETROLEUM NEWS gasoline index are higher now than they were during the summer months. The retail index is 1.64 cents above the price prevailing a year ago.

The good position of gasoline is due almost entirely to the record demand. Consumption so far this year has exceeded last year by almost 6 per cent. Added to this is the recent heavy demand from foreign countries. Most of the foreign countries have been building up their storage for petroleum products in view of the war threat.

Despite the increase in crude runs over last year, stocks of finished gasoline have been drawn upon more than they were last year. Gasoline stocks are now well below what is considered normal—and consumption is still running ahead of production.

While most of the advances along the eastern seaboard the past two weeks have been made to cover the increased costs of transportation and in no way increase potential profits, the fact that at this time of year the margin between costs and selling prices remains narrow indicates that there will be little of the chiseling that so often leads to lower prices.

Deliveries of gasoline from the Gulf to the eastern seaboard and to European countries have been so heavy recently that tankers have become almost impossible to obtain. The good movement from the Gulf has caused gasoline prices to hold, so that the increased costs of tankers has been added to the cost of delivery. It has been in no way compensated for by reductions in the cost of the gasoline.

Last week there was little activity at the Gulf. Most buyers have made arrangements for their requirements for the balance of the year. Most observers in a position to know conditions at the Gulf agree that gasoline stocks there are in good shape. Suppliers were not pushing sales.

There is some indication that pressure is being brought to bear from Washington on the companies who are selling petroleum products to Italy. Secretary Hull last week said that petroleum products are essential war materials. Their shipment to Italy is contrary to the spirit of the Neutrality Act, he emphasized.

Some observers are inclined to believe that the administration will take steps to stop shipments of oil to Italy. Whether they can do it legally or not is a question.

Just what effect it would have on oil markets is speculative. Most traders hesitate to make any prediction as they do not know just what percentage of the export shipments are headed for Italy.

The best guess seems to be that it would cause a reduction in export prices, but, due to the low gasoline inventories and the approach of the time to build them up in anticipation of the spring demand, it will not affect the domestic market.

No definite change was noted in conditions on the west coast. One independent company on the coast reduced its prices. It had not affected the general price level at the week end, but some traders could not see how a general reduction could be avoided.

Natural gasoline became scarce last week. Buyers bid up the price in attempts to obtain enough material to meet their requirements. Several suppliers found themselves oversold, and were forced to pay higher prices in order to cover their sales.

The lubricating oils remained firm. The good domestic demand for neutrals and the good export demand for dark and bright stocks was keeping inventories in good shape. Like the gasoline market, the outlook for the lubricating oils over the balance of the year is good, most traders agree.

N. P. N. Gasoline Index

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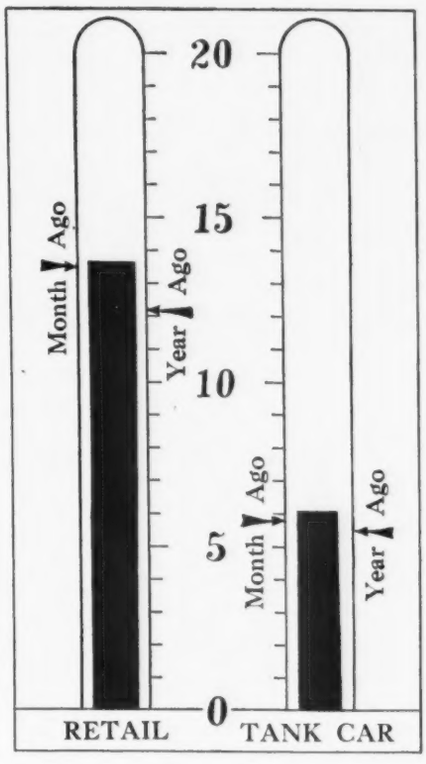

Retail index of 50 cities, ex-tax, and tank car is a weighted average of 13 wholesale markets for middle octane gasoline. The gasoline price index this week represents the following price in cents per gallon:

Date	Retail	Tank Car
Nov. 18	13.64	6.04
Month ago	13.53	5.84
Year ago	12.20	5.51

Nebraska Marketers Move

LINCOLN, Nov. 15.—The new address of the Nebraska Petroleum Marketers, Inc., is 503 Richards Block here, according to the official bulletin of the association. The association invites anyone visiting Lincoln to make these offices their headquarters. All correspondence should be addressed to the above address.

California

Gasoline Irregular

LOS ANGELES, Nov. 15

IRREGULARITY of wholesale and retail gasoline prices continued to feature Pacific Coast petroleum markets the past week. Quotations on all other products were essentially unchanged.

Pressure of excess gasoline in the hands of independent refiners and distributors was largely responsible for the disturbed conditions in the Los Angeles Basin area. Although an effort was made to absorb this excess, the quantity moved from the domestic market was not sufficient to stabilize the price structure.

Reports indicated that about 3 million gallons of competitive gasoline had been taken off the market during the week, but that approximately 12 million gallons still remained as a threat to price stability in the Basin area.

Another disturbing factor, was the reduction of both wholesale and retail gasoline prices by an independent refiner that in the past has uniformly adhered to major company schedules. Coming at a time when a majority of secondary companies had been induced to advance their prices to the major company level, this development caused a reversal of the upward price movement.

Tank wagon quotations on major company third grade gasoline, delivered to points in Los Angeles and Orange counties, were 10.5 cents a gallon, inclusive of 4 cents tax. Secondary companies generally posted the same figure for the major company product handled but were reported to be granting dealers extra discounts, in addition to the one cent per gallon nominally allowed.

Quotations on independent competitive brands of gasoline were irregular, ranging from 8.5 to 10 cents a gallon. At the latter figure, the retailer had a margin of only 2.5 cents a gallon, instead of the regular 3 cents margin between tank wagon and retail prices.

With the exception of the San Joaquin Valley, conditions in territories outside the Basin area were considered fairly satisfactory and no large amount of price cutting was reported. In the Valley, however, areas of keen competition showed a tendency to expand, due to the seasonal decline in consumption of gasoline and to an increase in independent plant facilities. In the Bakersfield district, bulk and retail prices of competitive brands of gasoline were at approximately the same levels as in the Basin.

No change was reported in natural gasoline quotations, which ranged from 5 to 5.5 cents a gallon, f. o. b. refinery. Supply continued in excess of the effective demand.

Gasoline quotations on Pacific Coast seaboard markets were firmer as a result of the loading at Los Angeles harbor of two tankers, each scheduled to carry approximately 9250 tons of gasoline to Italian Somaliland. No important changes were reported in quotations on other petroleum products.

Wax

Market Steady

NEW YORK, Nov. 16.—The market for crude scale wax remained tight in both the domestic and export markets during the week ended Nov. 16, manufacturers generally reported. Demand was steady enough to prevent any piling up of surplus stocks and in some quarters higher prices were expected. No scale was reported offered during the week at under 2.25 cents a pound, and apparently the amount of material available at this level was considerably less than in the previous week.

Refined waxes continued to show no appreciable change in market conditions. Stocks apparently were in a stable position and no price shading was reported.

Coastal

Market Quiet

NEW YORK, Nov. 16

CARGO markets at the Gulf generally were quiet during the week ended Nov. 16, with no particular amount of activity reported, either for export or domestic shipment.

No export gasoline buyers were reported inquiring for cargoes and the only actual inquiries reported during the week came from two French refiners who were each seeking a cargo of crude oil. At last reports no purchase had been made. The last cargo of crude sold for export to France was reported to have moved at $1.22 a barrel, f. o. b. the Gulf. Suppliers now report this market well sold up and were predicting higher prices.

Lack of actual inquiries in the export market gave suppliers plenty of time to speculate on the position of business relations with the Italian government. While American suppliers continue to bid freely on any Italian business which comes in the market, there appears to be a growing amount of pressure from Washington to "shame" these companies into discontinuing their sales to Italy. However, the sentiment among the trade appeared to be that there was nothing wrong in going after this business and they would continue doing so until definitely forbidden by the government.

Gasoline for coastwise movement remained in good position, suppliers reported. Tightness in the boat market continued to hamper a free movement of this product, but on the other hand, suppliers apparently were not overly anxious, or did not have the material, to push into the open market.

Fuel oils remained rather tight with no great amount of sales pressure reported. Kerosine was moving coastwise at 4 cents the Gulf, while the lowest sale of No. 2 fuel reported was at 3.25 cents.

Chicago

Market Spotty

CHICAGO, Nov. 16

DESPITE the fact that quoted prices have not seriously reacted throughout the week, the Mid-Western tank car gasoline market experienced more than the usual amount of backing and filling the week ended Nov. 16. A competitive market was created, which, many traders believed, was a serious threat to market prices.

Indications were that large company buying was active the latter part of the previous week and had extended into the opening days of this week. This, it was believed, explained the action of the market the past week. After opening in relatively good position, an increasing amount of slack made its appearance about the middle of the week, and continued to prevail until the end of the week.

While this trend undoubtedly was having its effect on market prices, sellers, while anxious to move products, generally were holding for at least the quoted lows.

The uncertainty of the market was making buyers cautious. There were indications that open market buyers were attempting to drive hard bargains when purchasing gasoline supplies. As a consequence, several resellers reported they were expending only a limited amount of sales effort on gasoline, fuel oil receiving the major portion of attention.

It was indicated that the period of storage withdrawals of gasoline stocks was nearing its end, and that the next several months would witness a goodly amount of gasoline accumulations.

The tank car gasoline market is expected by many to be comparatively steady throughout the winter months of storage accumulation.

Retail markets in the middle west continued unbalanced in many sections. There was some indication, how-

ever, that an effort would be made to correct the situation at Milwaukee, one of the more distressed points. Michigan gasoline was being sold in Milwaukee this week at 8 gallons for $1, or about 4 cents below the normal price of major brand third grade. Regular grades of gasoline were about 2 cents below normal.

Weather conditions the past week remained unfavorable to active gasoline consumption in most sections of the middle west.

Kerosine did not display anything unusual in its general set-up the past week. This commodity has been going along in the same general position for quite some time, with nothing appearing to disturb it.

Eastern

Prices Higher

NEW YORK, Nov. 16

TANK car and barge gasoline markets continued to improve along the eastern seaboard during the week ended Nov. 16, with price advances reported through the central portions instead of in New York and New England as in the previous week.

Following the action taken earlier in the northern seaboard markets, Standard Oil of New Jersey and the Atlantic Refining Co. on Nov. 11 and 12 advanced tank car gasoline prices 0.25 cents a gallon through the Philadelphia, Baltimore, Norfolk, Wilmington and Charleston districts. Some of the companies operating at these points appeared reluctant to advance their quotations, but by Nov. 15 they were virtually all up to the new level.

These advances bring the structure for 65 octane and above gasoline to 6.5 cents for tank car movement from terminals all along the eastern seaboard. Prices for 60-64 octane gasoline were about 0.25 cent below the higher octane price.

Gasoline consumption continued to hold at satisfactory levels during the week and suppliers still were hard put to get enough gasoline to supply their immediate sales requirements, they reported. Several who were short of gasoline said they still were scouring the market to buy or borrow enough to fill their orders until they had a boat coming in from the Gulf. This applied in the Baltimore and Philadelphia markets as well as at New York harbor they reported. Jobbers generally said that the market was tight and that they were not being offered much gasoline aside from their contract takings.

The tightness in the charter market still was playing a prominent part in holding the seaboard gasoline market on a stable basis. Late reports were that there were no "clean" boats available at under 32 cents a barrel and that owners were asking up to 35 cents. This meant a per gallon cost of 0.75 cent, which added to the minimum price of 5.5 cents for high octane at the Gulf gave a laid-in price at the harbor of 6.25 cents, compared to a barge selling price of 6.25 cents.

The kerosine market was slightly troubled at New York harbor as some suppliers moved material in barge lots at 4.75 cents, while others were getting 4.875 cents.

Mid-Continent

Natural Higher

TULSA, Nov. 16

NATURAL gasoline prices last week were working their way upward to levels existing before the price cut of a month ago. A renewal of buying which got under way the first of the month cleared the market of surplus supplies and furnished a ready outlet for current production.

With production already committed, some suppliers recently have attempted to cover their sales in the open market. They found only odd cars of Grade 26-70 at 3.5 and 3.75 cents. Unable to buy all the material they needed at these prices they offered higher prices. The latter part of the week sales were reported at 3.75 to 3.875 cents in Texas and 4c in Oklahoma. As the week closed supplies still were not plentiful.

Natural gasoline orders placed in the Mid-Continent by blenders who normally obtain supplies from the Appalachian district would indicate that material in that district was not freely available.

Some manufacturers reported that Mid-Continent refiners who had doubled their takings of natural the first half of November were not ordering out so much over the last half. Others could see little change in volume of orders from their regular trade.

Sales of motor fuel in the open market were light the second week of November. Inclement weather has made considerable inroad into consumption. Despite the sluggishness of gasoline movement, there was little surplus showing up. A check revealed that most refiners either had made, or were contemplating, reductions in refinery operations.

This idea of keeping gasoline production balanced with consumption was fairly general. If carried out, observers were confident market prices would fluctuate only slightly over the next month or two. Contract movement has fallen off some, but not in proportion to open market sales. Interrefinery purchases still were conspicuous.

Kerosine was lifeless. While there were no distress offerings available, buyers reported supplies were freely available. Most Oklahoma refiners stuck to the 3.375-cent quotations for the 41-43 w.w. grade. East Texas kerosine was quoted 0.125 cent under that price f. o. b. plants.

Mid-Continent and South Texas lubricating oils were unchanged the past week. Mid-Continent oils were moving readily to contract customers. Open market business was fair. South Texas lubes were sluggish.

Wax was scarcer in Oklahoma and Texas. Lack of supplies made it difficult to ascertain the actual condition of the market.

Pennsylvania

Trading Quiet

CLEVELAND, Nov. 16

WHILE open market trading was rather slack in the Pennsylvania market the past week, most products remained steady as offerings were restricted. Several refiners reported they were entirely sold out for November, while others reported they had sold most of their November production. With but little exception open market offerings the balance of the month will be confined to odd lots, most reports indicated.

Cylinder stocks and wax were getting the most play. No definite price change was noted in either commodity, although apparently some refiners were inclined to advance their prices as offerings declined.

There has been a steady increase in demand for the cylinder stocks for the past two or three weeks. Most of the surplus offered at that time has now been taken off the market and inventories are now more nearly normal, trade reports indicated. Several refiners advanced their quotations for dark stocks during the week, thereby reducing the volume of material available at current prices.

Most of the demand has been for 600 steam refined, 650 steam refined, and 600 flash stock. Like bright stock, most of the demand for the dark stocks was said to be originating in Europe.

Wax was very active. Buyers were circulating inquiries throughout the field in attempts to pick up material to meet their requirements. Most sellers were sold about a month ahead, while a few reported they would not be offering wax the remainder of the year. Spot offerings of wax were virtually non-existent.

A good balance was maintained between supply and demand for neutral oils. Open market trading was not as active as it was in October, but most sellers were still busy filling the orders

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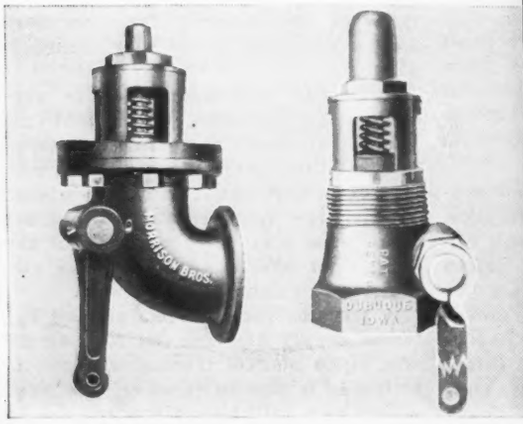

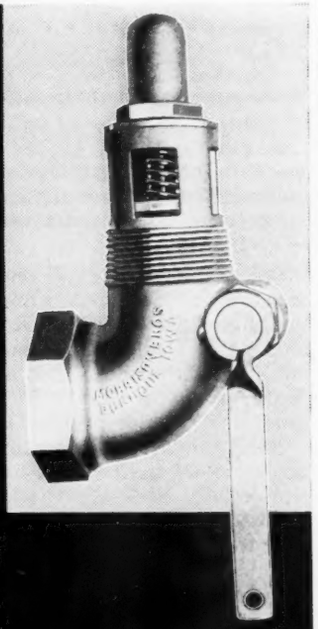

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placed last month. Most observers believe there will be another flurry of buying of neutrals just as soon as winter weather actually arrives. Higher prices are anticipated on the next buying wave.

Little change was noted in bright stock. Most sellers were sold up fairly well. Most reports indicated that inventories were showing a slight increase, but inventories were believed to be below normal for this season of the year.

The status of 65-octane gasoline was about the same. Buyers apparently were taking every gallon offered at current prices. The advances in 65 octane along the eastern seaboard was welcomed by Pennsylvania refiners.

Refiners in the lower field advanced their kerosine prices 0.125 cent the past week. This made their price for 45 water white kerosine at 4.75 cents, the same as the upper field. Slightly colder weather was expected to stimulate demand.

Fuel oil was scarce in some quarters, but apparently buyers had no difficulty in obtaining all the material they needed.

Lube Tax Not Assessed On Top Cylinder Oil

WASHINGTON, Nov. 18.—Where small quantities of lubricating oil are added to gasoline as a top cylinder lubricant the oil is not taxable as such but carries only the gasoline tax according to a ruling by the Bureau of Internal Revenue issued today.

The producer of gasoline is thus allowed to buy the oil tax free for blending with his gasoline.

This new ruling will not apply in the case where substantial quantities of oil are added to gasoline and the mixture is sold as a combination fuel and lubricant as in the case of outboard motors which have no other provision for cylinder lubrication except through the fuel.

Steel Company Expands Motor Fuel Sales

BIRMINGHAM, Ala. — The Sloss Sheffield Steel & Iron Co. of Birmingham continues to expand its operations in the gasoline business in order to provide a ready outlet for benzol, a by-product of its coke ovens. Three new stations retailing the concern's "Sloss Special Benzol" motor fuel have opened up in the last 30 days. The company now has 18 independent outlets in the city and in addition operates a half dozen retail stations of its own at its plants and commissaries.

REFINERY TANK CAR MARKETS

Prices in cents per gallon, tank car lots, except where otherwise noted. Prices are those to domestic jobbers who resell to consumers. They do not represent inter-refinery sales, or sales for export. Federal, state or municipal taxes not included. Prices quoted apply on products made from legally produced crude.

Gasoline *and* Naphtha

	Nov. 18	Nov. 11	Nov. 4
Oklahoma			
48-54, 450 e.p. naphtha	4.625– 4.75	4.625– 4.75	4.625– 4.75
U. S. Motor gasoline, by octane numbers:			
62 and below (3rd grade)	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875
63-70 octane (regular)	5.625– 5.75	5.625– 5.75	5.625– 5.75
71 and above	.....	.....	.....
60-62, 400 e.p. gasoline	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875
64-66, 375 e.p. gasoline	4.875– 5.00	4.875– 5.00	4.875– 5.00
68-70, 350-360 e.p. gasoline	5.00 – 5.125	5.00 – 5.125	5.00 – 5.125
Western Penna. (Quotations and/or sales prices to car unloaders)			
Bradford-Warren:			
52-54 naphtha	5.125– 5.25	5.125– 5.25	5.00 – 5.125
Motor gasoline:			
U. S. Motor (58-62°)	5.25 – 5.375	5.25 – 5.375	5.125– 5.25
Minimum 60 octane	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875
Minimum 65 octane	7.00 – 7.125	7.00 – 7.125	7.00 – 7.125
Minimum 70 octane	.....	.....	.....
64-66, 390 e.p. gasoline	5.375– 5.50	5.375– 5.50	5.375– 5.50
68-70, 350-360 e.p. gasoline	5.625– 5.75	5.625– 5.75	5.625– 5.75
Other districts:			
52-54 naphtha	5.125– 5.25	5.125– 5.25	5.00 – 5.125
54-56 naphtha	5.25 – 5.375	5.25 – 5.375	5.125– 5.25
Motor gasoline:			
U. S. Motor (58-62°)	5.25 – 5.375	5.25 – 5.375	5.125– 5.25
Minimum 60 octane	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875
Minimum 65 octane	7.00 – 7.125	7.00 – 7.125	7.00 – 7.125
Minimum 70 octane	.....	.....	.....
64-66, 390 e.p. gasoline	5.375– 5.50	5.375– 5.50	5.375– 5.50
68-70, 350-360 e.p. gasoline	5.625– 5.75	5.625– 5.75	5.625– 5.75
California (3c tax to be added to prices if used in state)			
54-58 U. S. Motor, 437 e.p. for in-state shipment	5.00 – 6.50	5.00 – 6.50	5.50 – 7.00
54-58 U. S. Motor, 437 e.p. for outside state shipment	4.75 – 6.50	4.75 – 6.50	5.50 – 7.00
58-61, 375-400 e.p. gasoline, 65 octane and above	7.00 – 8.00	7.00 – 8.00	7.50 – 8.50
†***North Texas*** (F.o.b. Wichita Falls district for shipment to Texas and New Mexico destinations; Group 3 prices quoted on northern shipments).			
U. S. Motor gasoline, by octane numbers:			
62 and below (3rd grade)	4.75	4.75	4.75
63-70 octane (regular)	5.625	5.625	5.625
71 and above	.....	.....	.....
60-62, 400 e.p. gasoline	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875
64-66, 375 e.p. gasoline	4.875– 5.00	4.875– 5.00	4.875– 5.00
68-70, 350-360 e.p. gasoline	5.00 – 5.125	5.00 – 5.125	5.00 – 5.125
Kansas (F. o. b. refinery, Kansas destination)			
U. S. Motor gasoline, by octane numbers:			
62 and below (3rd grade)	5.00 – 5.125	5.00 – 5.125	5.00 – 5.125
63-70 octane (regular)	5.875– 6.00	5.875– 6.00	5.875– 6.00
71 and above	.....	.....	.....
60-62, 400 e.p. gasoline	5.00 – 5.125	5.00 – 5.125	5.00 – 5.125
†***West Texas and New Mexico*** (F. o. b. W. Texas and N. Mex. refinery for unrestricted shipment)			
U. S. Motor gasoline, by octane numbers:			
62 and below (3rd grade)	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875
63-70 octane (regular)	5.625– 5.75	5.625– 5.75	5.625– 5.75
71 and above	.....	.....	.....
†***East Texas*** (F. o. b. East Texas refinery for unrestricted shipment)			
U. S. Motor gasoline, by octane numbers:			
62 and below (3rd grade)	4.625– 4.75	4.625– 4.75	4.625– 4.75
63-70 octane (regular)	.....	.....	.....
71 and above	.....	.....	.....
60-62, 400 e.p. gasoline	4.75	4.75	4.75
North Louisiana (For Louisiana and Arkansas destination)			
U. S. Motor gasoline:			
62 octane and below	5.50	5.50	5.50
63-70 octane number	6.25	6.25	6.25
71 octane and above	.....	.....	.....
Arkansas (For Arkansas and Louisiana destination)			
U. S. Motor gasoline:			
62 octane and below	5.50	5.50	5.50
63-70 octane number	6.25	6.25	6.25
71 octane and above	.....	.....	.....

•Nominal. †Refiners generally receive from 0.25c to 0.5c per gallon more for gasoline and kerosine for local or differential territory shipment.

	Nov. 18	Nov. 11	Nov. 4
Ohio (Quotations of S. O. Ohio. Delivered any point in Ohio).			
U. S. Motor gasoline	8.375	8.375	8.375
Above 65 octane number	8.625	8.625	8.625

Natural Gasoline

(Prices shown f.o.b. Group 3 and Breckenridge represent majority of sales made on dates shown to blenders on the freight basis shown below, although shipments may originate in other manufacturing districts, such as East Texas, Panhandle, Southwest Texas or Kansas).

F.o.b. Group 3			
Grade 26-70	4.00	3.875	3.75 – 3.875
F.o.b. Breckenridge			
Grade 26-70	3.75 – 3.875	3.625	3.50
California (F. o. b. plants in Los Angeles basin)			
75-85, 375-390 e.p. for blending	5.00 – 5.50	5.00 – 5.50	5.00 – 5.75

Kerosine

Western Penna. (Quotations and/or sales prices to car unloaders)			
Bradford-Warren:			
45 w.w. kerosine	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875
46 w.w. kerosine	4.875– 5.00	4.875– 5.00	4.875– 5.00
47 w.w. kerosine	5.00 – 5.125	5.00 – 5.125	5.00 – 5.125
Other districts:			
45 w.w. kerosine	4.75 – 4.625	4.625– 4.75	4.625– 4.75
46 w.w. kerosine	4.875– 5.00	4.75 – 4.875	4.75 – 4.875
47 w.w. kerosine	5.00 – 5.125	4.875– 5.00	4.875– 5.00
Ohio (Quotations of S. O. Ohio. Delivered any point in Ohio).			
Kerosine	6.00	6.00	6.00
Oklahoma			
41-43 w.w. kerosine	3.375– 3.50	3.375– 3.50	3.375– 3.50
42-44 w.w. kerosine	3.50 – 3.625	3.50 – 3.625	3.50 – 3.625
Kansas (F. o. b. refinery, Kansas destination)			
41-43 w.w. kerosine	3.625– 3.875	3.625– 3.875	3.625– 3.875
42-44 w.w. kerosine	3.875– 4.00	3.875– 4.00	3.875– 4.00
†***North Texas*** (F.o.b. Wichita Falls district for shipment to Texas and New Mexico destinations; Group 3 prices quoted on northern shipments).			
41-43 w.w. kerosine	3.50 – 3.625	3.50 – 3.625	3.375– 3.50
†***East Texas*** (F.o.b. East Texa refinery for unrestricted shipment)			
41-43 w.w. kerosine	3.125– 3.25	3.125– 3.25	3.125– 3.25
North Louisiana (For Louisiana and Arkansas destination)			
41-43 w.w. kerosine	3.75	3.75	3.75
Arkansas (For Arkansas and Louisiana destination)			
41-43 w.w. kerosine	4.25	4.25	4.25
California (F.o.b. California refineries)			
38-40 w.w. kerosine	4.00 – 5.00	4.00 – 5.00	4.00 – 5.00

Gas *and* Fuel Oils

Western Penna. (Quotations and/or sales prices to car unloaders)			
Bradford-Warren:			
36-40 fuel oil	4.25 – 4.375	4.25 – 4.375	4.125– 4.25
‡*Other districts*:			
36-40 fuel oil	4.125– 4.25	4.125– 4.25	4.00 – 4.125
‡Not including Pittsburgh.			
Oklahoma (F.o.b. Oklahoma refineries			
Gas oils:			
No. 1 white	3.125– 3.25	3.125– 3.25	3.125– 3.25
No. 1 straw	3.00 – 3.125	3.00 – 3.125	3.00 – 3.125
No. 2 straw	3.00 – 3.125	3.00 – 3.125	3.00 – 3.125
No. 2 dark	2.875– 3.00	2.875– 3.00	2.875– 3.00
U. G. I. gas oil	2.25	2.25 – 2.375	2.25 – 2.375
Fuel oils: (Prices per barre of 42 U. S. gallons)			
28-30, zero	$1.15 –$1.175	$1.15 –$1.175	$1.15 –$1.175
28-30	$1.00	$1.00	$1.00
24-26	$0.725–$0.75	$0.70 –$0.75	$0.70 –$0.75
18-22	$0.70 –$0.725	$0.675–$0.725	$0.675–$0.725
14-16	$0.60 –$0.65	$0.60 –$0.65	$0.60 –$0.65

(*Continued on page* 96)

PRICES in the various petroleum markets quoted regularly in National Petroleum News are compiled by the staff of Platt's Oilgram, an affiliated daily oil market reporting service. Barrels are of 42 U. S. gallons. Prices appearing in each issue of National Petroleum News are the same as those carried in the Monday edition of the Oilgram. For information regarding the Oilgram daily news and market service write Platt's Oilgram, Cleveland.

(*Continued from page 95*)

	Nov. 18	Nov. 11	Nov. 4
Kansas (F.o.b. refinery, Kansas destination)			
No. 1 straw	3.375	3.375	3.375
18-22 fuel oil (per bbl.)	$0.725–$0.75	$0.725–$0.75	$0.725–$0.75
10-14 fuel oil (per bbl.)	$0.625–$0.65	$0.625–$0.65	$0.625–$0.65
North Texas (F.o.b. Wichita Falls district for shipment to Texas and New Mexico; Group 3 prices quoted on northern shipments).			
No. 1 straw	3.125	3.125	3.125
No. 1 white	3.25	3.25	3.25
No. 2	3.00	3.00	3.00
U.G.I. gas oil	2.125	2.125	2.125
24-26 fuel oil (per bbl.)	$0.70 –$0.725	$0.70 –$0.725	$0.70 –$0.725
18-22 fuel oil (per bbl.)	$0.65 –$0.675	$0.65 –$0.675	$0.65 –$0.675
West Texas (F.o.b. West Texas refineries for unrestricted shipment).			
No. 2	*2.75 – 3.00	*2.75 – 3.00	*2.875– 3.00
18-22 fuel oil (per bbl.)	$0.65	$0.65	$0.65
East Texas (F.o.b. East Texas refineries for unrestricted shipment).			
No. 1 white	*3.00 – 3.125	*3.00 – 3.125	*3.00 – 3.125
No. 2	*2.75 – 2.875	*2.75 – 2.875	*2.75 – 2.875
U.G.I. gas oil	2.125– 2.25	2.125– 2.25	2.125– 2.25
24-26 fuel oil	$0.575–$0.60	$0.575–$0.60	$0.575–$0.60
20-24 fuel oil	$0.55 –$0.575	$0.575	$0.575
North Louisiana (For Louisiana and Arkansas destination).			
No. 2	3.00 – 3.125	3.00 – 3.125	3.00 – 3.125
U.G.I. gas oil	2.875– 3.00	2.875– 3.00	2.875– 3.00
20-24 fuel oil	$1.00 –$1.025	$1.00 –$1.025	$1.00 –$1.025
16-20 fuel oil	$0.90 –$0.925	$0.90 –$0.925	$0.90 –$0.925
10-14 fuel oil	$0.75 –$0.80	$0.75 –$0.80	$0.75 –$0.80
Arkansas (For Arkansas and Louisiana destination)			
No. 2	3.50	3.50	3.50
28-30 gas oil, zero	3.25	3.25	3.25
20-24 fuel oil (per bbl.)	$0.825–$0.875	$0.825–$0.875	$0.825–$0.875
16-20 fuel oil	$0.725–$0.775	$0.725–$0.775	$0.725–$0.775
10-14 fuel oil	$0.60 –$0.65	$0.60 –$0.65	$0.60 –$0.65
California			
San Joaquin Valley, per bbl.:			
Grade C fuel oil	$0.50 –$0.75	$0.50 –$0.75	$0.50 –$0.75
Diesel fuel oil	$1.05 –$1.45	$1.05 –$1.45	$1.05 –$1.45
Stove distillate	$1.25 –$1.85	$1.25 –$1.85	$1.25 –$1.85
Los Angeles, per bbl.:			
Grade C fuel oil	$0.60 –$0.95	$0.60 –$0.95	$0.60 –$0.95
Diesel fuel	$1.05 –$1.45	$1.05 –$1.45	$1.05 –$1.45
Stove distillate	$1.25 –$1.85	$1.25 –$1.85	$1.25 –$1.85
San Francisco, per bbl.:			
Grade C fuel oil	$1.00	$1.00	$1.00
Diesel fuel	$1.68	$1.68	$1.68
Stove distillate	$2.10	$2.10	$2.10

Neutral Oils

Western Penna. (Quotations and/or sales prices to car unloaders)

Viscous Neutrals (Viscosity at 70° F.)

200 Vis. (180 at 100°) No. 3 color, 420-425 flash:			
0 pour test	25.00 –25.50	25.00 –25.50	25.00 –25.50
10 pour test	24.00 –24.50	24.00 –24.50	24.00 –24.50
15 pour test	23.50 –24.00	23.50 –24.00	23.50 –24.00
25 pour test	22.50 –23.00	22.50 –23.00	22.50 –23.00
180 Vis. (165 at 100) No. 3 color, 410-415 flash:			
25 pour test	21.00 –21.50	21.00 –21.50	21.00 –21.50
150 Vis. (143-100) No. 3 color, 400-405 flash:			
0 pour test	20.50 –21.00	20.50 –21.00	20.50 –21.00
10 pour test	19.50 –20.00	19.50 –20.00	19.50 –20.00
15 pour test	19.00 –19.50	19.00 –19.50	19.00 –19.50
25 pour test	18.00 –18.50	18.00 –18.50	18.00 –18.50

South Texas (F.o.b. South Texas refineries, for domestic shipment)

Vis. Color	(*Viscosity at* 100° F.; *pour test* 0)		
Pale Oils:			
100 No. 1½-2½	5.00	5.00	5.00
200 No. 2-3	7.00	7.00	7.00
300 No. 2-3	7.50	7.50	7.50
500 No. 2½-3½	8.50	8.50	8.50
750 No. 3-4	9.00	9.00	9.00
1200 No. 3-4	9.50	9.50	9.50
2000 No. 3-4	9.75 –10.00	9.75 –10.00	9.75 –10.00
Red Oils:			
200 No. 5-6	7.00	7.00	7.00
300 No. 5-6	7.50	7.50	7.50
500 No. 5-6	8.50	8.50	8.50
750 No. 5-6	9.00	9.00	9.00
1200 No. 5-6	9.50	9.50	9.50
2000 No. 5-6	9.75 –10.00	9.75 –10.00	9.75 –10.00

Note: South Texas red oil prices shown above cover oils with green cast; blue cast red oils are slightly lower in some cases.

*Nominal

Mid-Continent (Viscosity at 100° F.; F. o. b. Tulsa basis Prices represent quotations and sales)

0 to 10 Pour Point:

Vis. Color	Nov. 18	Nov. 11	Nov. 4
Pale Oils:			
60-85—No. 2	5.25	5.25	5.25
86-110—No. 2	5.75	5.75	5.75
150—No. 3	10.00	10.00	10.00
180—No. 3	11.25	11.25	11.25
200—No. 3	11.75	11.75	11.75
*250—No. 3	13.75	13.75	13.75
280—No. 3	14.75	14.75	14.75
300—No. 3	15.25	15.25	15.25
Red Oils:			
180—No. 5	10.25	10.25	10.25
200—No. 5	10.75	10.75	10.75
*250—No. 5	12.75	12.75	12.75
280—No. 5	13.75	13.75	13.50
300—No. 5	14.00	14.00	13.25

Note: Non-Viscous pale oils (60 to 110 Vis.) with a 15 to 25 pour point are quoted 0.5c under 0 to 10 pour test oils; pale and red viscous oils (150 to 300 Vis.) with 15 to 25 pour point are quoted 1c under 0 to 10 pour test oils. Viscous oils (150 to 300 Vis.) with a No. 4 color are quoted 0.5c above No. 5 color oils

*This replaces 240 Vis. No. 3 color.

Chicago (F.o.b. Chicago refineries) (Vis. at 100° F.)

Vis. Color			
Pale Oils, *15 to 30 pour point:			
60-85—No. 2	6.50	6.50	7.00
86-110—No. 2	7.00	7.00	7.50
150—No. 3	10.00	10.00	10.25
180—No. 3	11.25	11.25	11.75
200—No. 3	11.75	11.75	12.25
250—No. 3	13.75	13.75	14.25
Red Oils, *15 to 30 Pour Point:			
180—No. 5	10.25	10.25	10.75
200—No. 5	10.75	10.75	11.25
250—No. 5	12.75	12.75	13.25
280—No. 5	13.25	13.25	13.75
300—No. 5	13.50	13.50	14.00

*Oils with 0 to 10 pour point bring 1c higher than above prices. To obtain prices delivered in Chicago, add 0.25c per gal.

California (F.o.b. California refineries; Viscosity at 100° F.)

All neutral oils, 11.5c per gal. in tank car lots; and 13.5c in iron bbls., to refiners only, excluding federal tax.

Cylinder Stocks

Mid-Continent (F.o.b. Tulsa basis. Prices represent quotations and sales

Bright Stocks:			
190-200 Vis. at 210° D	20.00	20.00	20.00
150-160 Vis. at 210° D:			
0 to 10 pour test	17.00	17.00	17.00
10 to 25 pour test	16.50	16.50	16.50
25 to 40 pour test	16.00	16.00	16.00
150-160 Vis. at 210° E	16.00	16.00	16.00
120 Vis. at 210° D:			
0 to 10 pour test	16.50	16.50	16.50
10 to 25 pour test	16.00	16.00	16.00
25 to 40 pour test	15.50	15.50	15.50
600 Stm. Rfd. Dark Green	5.50 – 6.50	5.50 – 6.50	5.50 – 6.50
600 Stm. Rfd. Olive Green	6.50 – 8.00	6.50 – 8.00	6.50 – 8.00
631 Steam Refined	*10.00	*10.00	*10.00
Black oil	3.25 – 3.375	3.25 – 3.375	3.25 – 3.375

*Only one refiner quoting.

Chicago (F.o.b. Chicago district refineries) (Viscosity at 210°)

Unfiltered Steam Refined:			
140	9.00	9.00	9.00 – 9.50
160	10.00	10.00	10.00 –10.50
200	11.00	11.00	11.00 –11.50
Bright stocks, 160 vis. at 210 No. 8 color:			
0 to 10 pour point	18.75	18.75	18.75 –19.25
15 to 25 pour point	18.25	18.25	18.25 –18.75
30 to 40 pour point	17.75	17.75	17.75 –18.25
E filtered Cyl. Stock	14.00	14.00	14.00 –14.50

(*Continued on page 97*)

REFINERY TANK CAR MARKETS

CONTINUED FROM PAGE 96

Cylinder Stocks (cont'd)

	Nov. 18	Nov. 11	Nov. 4
Western Penna. (A.S.T.M. tests; quotations and/or sales prices to car unloaders)			
600 stm. rfd. filterable	9.50 –10.00	9.50 –10.00	9.50 –10.00
650 steam refined	11.00 –11.50	11.00 –11.50	11.00 –11.50
600 flash	12.00 –12.50	12.00 –12.50	12.00 –12.50
630 flash	17.00 –17.50	17.00 –17.50	17.00 –17.50
600 Warren E	13.00 –13.50	13.00 –13.50	13.00 –13.50
Bright stock, 145-155, vis. at 210°, 540-550 flash, No. 8 color:			
10 pour test	22.00 –22.50	22.00 –22.50	22.00 –22.50
15 pour test	21.00 –21.50	21.00 –21.50	21.00 –21.50
20 pour test	20.00 –20.50	20.00 –20.50	20.00 –20.50
25 pour test	19.00 –19.50	19.00 –19.50	19.00 –19.50

Petrolatums

Western Penna. (Per pound, in barrels, carload lots, f.o.b. Penna. refinery. In tank cars, 0.5c per pound less. Quotations are from majority of petrolatum makers).

Snow White	6.625	6.625	6.625
Lily White	5.625	5.625	5.625
Cream White	4.625	4.625	4.625
Light Amber	2.75	2.75	2.75
Amber	2.50	2.50	2.50
Red	2.00 – 2.125	2.00 – 2.125	2.00 – 2.125

Wax

Western Penna. (Per pound, f.o.b. New York)

122-124 wh. crude scale, A.m.p.	2.25 – 2.30	2.25 – 2.30	2.25 – 2.30
124-126 wh. crude scale, A.m.p.	2.30 – 2.35	2.30 – 2.35	2.25 – 2.30

Oklahoma (Per pound in barrels; in a few instances, per pound in burlap bags; f.o.b. Oklahoma refineries)

124-126 wh. crude scale. A.m.p.	2.25 – 2.375	2.25 – 2.375	2.25

Chicago (F.o.b. Chicago district refineries, in cents per pound, in bags carload lots. Melting points A.S.T.M. method; add 3° F. to convert into A.m.p.)

Fully refined:			
122-124	4.40 – 4.50	4.40 – 4.50	4.40 – 4.50
125-127	4.65 – 4.75	4.65 – 4.75	4.65 – 4.75
127-129	4.80 – 4.90	4.80 – 4.90	4.80 – 4.90
130-132	*5.20 – 5.30	*5.20 – 5.30	*5.20 – 5.30
132-134	*5.45 – 5.55	*5.45 – 5.55	*5.45 – 5.55
135-137	*6.20 – 6.30	*6.20 – 6.30	*6.20 – 6.30

*Same prices quoted in bags or slabs loose.

MID-WESTERN TANK CAR MARKETS

Following prices are in cents per gallon, except fuel oil in barrels of 42 U. S. gallons, in tank car lots, representing majority of sales of products made by Chicago sellers, from legally produced crude to jobbers on Group 3 freight basis, although shipments may originate in other South-western or Mid-western refining districts. Prices do not include state or federal taxes.

Gasoline

U. S. Motor gasoline:	Nov. 18	Nov. 11	Nov. 4
62 octane and below (3rd grade)	4.75	4.75	4.75
63-70 octane (regular)	5.50 – 5.75	5.50 – 5.75	5.50 – 5.75
71 octane and above	....	....	....
60-62, 400 e.p.	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875
64-66, 375 e.p.	4.875– 5.00	4.875– 5.00	4.875– 5.00
68-70, 350-360 e.p.	5.00 – 5.125	5.00 – 5.125	5.00 – 5.125

Kerosine

41-43 w.w.	3.25 – 3.375	3.25 – 3.375	3.25 – 3.375
42-44 w.w.	3.375– 3.50	3.375– 3.50	3.375– 3.50

Fuel *and* Gas Oils

Domestic:			
No. 1 prime white	3.125– 3.25	3.125– 3.25	3.125– 3.25
No. 1 straw	3.00 – 3.25	3.00 – 3.25	3.00 – 3.25

*Formerly Chicago Tank Car Markets.

	Nov. 18	Nov. 11	Nov. 4
No. 2 straw	2.875– 3.00	2.875– 3.00	2.875– 3.00
No. 2 dark	2.75 – 2.875	2.75 – 2.875	2.75 – 2.875
No. 3	2.625– 2.75	2.625– 2.75	2.625– 2.75
No. 4 (per bbl.)	$0.85 –$0.90	$0.85 –$0.90	$0.85 –$0.90
No. 5 (per bbl.)	$0.625–$0.65	$0.625–$0.65	$0.625–$0.65
Industrial:			
No. 4, (per bbl.)	$0.75 –$0.80	$0.75 –$0.80	$0.75 –$0.80
No. 5, (per bbl.)	$0.575–$0.60	$0.575–$0.60	$0.575–$0.60
No. 6, (per bbl.)	$0.45 –$0.50	$0.45 –$0.50	$0.45 –$0.50
U.G.I. gas oil	2.25 – 2.375	2.25 – 2.375	2.25 – 2.375

Naphtha *and* Solvent

Stoddard solvent	6.375	6.375	6.375
V. M. & P. naphtha	6.875	6.875	6.875
Cleaners' naphtha	6.875	6.875	6.875
Mineral spirits	5.875	5.875	5.875
Rubber solvent	6.875	6.875	6.875
Lacquer diluent	7.875	7.875	7.875

DAILY GASOLINE PRICES

Daily range of gasoline prices (cents per gallon) in tank cars, as reported in PLATT'S OILGRAM, (Week Ended Nov. 15, 1935)

	Nov. 11	Nov. 12	Nov. 13	Nov. 14	Nov. 15
U. S. Motor, 62 octane & below (3rd grade):					
East Texas	4.625– 4.75	4.625– 4.75	4.625– 4.75	4.625– 4.75	4.625– 4.75
*North Texas	4.75	4.75	4.75	4.75	4.75
West Texas	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875
Oklahoma	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875	4.75 – 4.875
Mid-Western (Group 3 basis)	4.75	4.75	4.75	4.75	4.75
U. S. Motor, 63-70 octane (regular):					
East Texas	....	....	....	....	....
*North Texas	5.625	5.625	5.625	5.625	5.625
West Texas	5.625– 5.75	5.625– 5.75	5.625– 5.75	5.625– 5.75	5.625– 5.75
Oklahoma	5.625– 5.75	5.625– 5.75	5.625– 5.75	5.625– 5.75	5.625– 5.75
Mid-Western (Group 3 basis)	5.50 – 5.75	5.50 – 5.75	5.50 – 5.75	5.50 – 5.75	5.50 – 5.75
Motor Gasoline, 60-64 octane					
New York harbor	6.25	6.25	6.25	6.25	6.25
Philadelphia district	6.00	6.00 – 6.25	6.00 – 6.25	6.25	6.25
Baltimore district	6.00	6.00 – 6.25	6.00 – 6.25	6.25	6.25
Motor Gasoline, 65 octane & above					
New York harbor	6.50	6.50	6.50	6.50	6.50
Philadelphia district	6.25	6.25 – 6.50	6.25 – 6.50	6.50	6.50
Baltimore district	6.25	6.25 – 6.50	6.25 – 6.50	6.50	6.50
U. S. Motor Gasoline					
Bradford-Warren (Western Penna.)	5.25 – 5.375	5.25 – 5.375	5.25 – 5.375	5.25 – 5.375	5.25 – 5.375
Other districts (Western Penna.)	5.25 – 5.375	5.25 – 5.375	5.25 – 5.375	5.25 – 5.375	5.25 – 5.375
Motor Gasoline, Minimum 60 octane					
Bradford-Warren (Western Penna.)	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875
Other districts (Western Penna.)	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875	6.75 – 6.875
Motor Gasoline, Minimum 65 octane					
Bradford-Warren (Western Penna.)	7.00 – 7.125	7.00 – 7.125	7.00 – 7.125	7.00 – 7.125	7.00 – 7.125
Other districts (Western Penna.)	7.00 – 7.125	7.00 – 7.125	7.00 – 7.125	7.00 – 7.125	7.00 – 7.125

*For shipment to Texas and New Mexico destinations; Group 3 prices are quoted on northern shipments.

TANK WAGON, SERVICE STATION MARKETS

Tax column includes 1c federal tax, state gasoline tax, also city and county taxes as indicated in footnotes, and inspection fees, as shown in general footnote. These prices in effect Nov. 18, 1935, as posted by principal marketing companies at their headquarters offices, but subject to later corrections.

S. O. New Jersey

Essolene

	Consumer Tank Car	Dealer T.W.	Taxes	Posted S.S.	Kerosine T.W.
Atlantic City, N. J.	7	9.5	4	17	9
Newark, N. J.	7	9.5	4	17	7.5
Annapolis, Md.	7.3	9.8	5	18.3	10
Baltimore, Md.	6.8	9.3	5	17.8	7.5
Cumberland, Md.	8.3	10.8	5	19.3	12.7
Washington, D. C.	7	9.5	3	16	9
Danville, Va.	8.1	10.6	6	20.1	12.9
Norfolk, Va.	6.6	9.1	6	18.6	11.3
Petersburg, Va.	7.3	9.8	6	19.3	11.7
Richmond, Va.	7.3	9.8	6	19.3	11.7
Roanoke, Va.	8.3	10.8	6	20.3	12.9
Charleston, W. Va.	7.5	10	5	18.5	12.6
Parkersburg, W. Va.	6.8	9.3	5	17.8	11.2
Wheeling, W. Va.	8	10.5	5	19	12.2
Charlotte, N. C.	8.4	10.9	7	21.4	12.9
Hickory, N. C.	8.7	11.2	7	21.7	13.1
Mt. Airy, N. C.	8.7	11.2	7	21.7	13.2
Raleigh, N. C.	8.1	10.6	7	21.1	12.7
Salisbury, N. C.	8.5	11	7	21.5	13
Charleston, S. C.	6.7	9.2	7	19.7	11.3
Columbia, S. C.	8	10.5	7	21	12.6
Spartanburg, S. C.	8.4	10.9	7	21.4	12.9

Price basis to undivided dealers: Dealer t.w. price less 0.5c per gal.

Price basis to commercial consumers: Beginning Feb. 11, 1935, all new commercial consumers will be signed on following differentials over tank car price, on yearly purchases: up to 35,999 gals., 2.5c over t.c.; 36,000 to 119,999 gals., 2c; 120,000 to 239,999 gals., 1.5c; 240,000 to 479,999 gals., 1c; and over 480,000 gals., 0.5c.

Above prices apply only when deliveries are made in lots of 50 or 100 gals. at one time, depending on code region in which deliveries are effected.

If deliveries are made in less than these minimum quantities, s.s. price at time and place of delivery applies.

Non-contract customers will be billed at 2.5c over tank car price at time and place of delivery.

Kerosine Discount: 1c off t.w. price for 25 gals. or more, under contract thru territory (Baltimore City contract not necessary) except no discount in state of New Jersey.

Socony-Vacuum Oil Co., Inc.

(S. O. New York Division)

Socony Mobilgas

	"Split" Dealer T.W.	Taxes	Total "Split" Dealer T.W.	S.S.	Kerosine T.W.
Metropolitan N. Y. City: Boroughs of Manhattan, Bronx and Queens	10.25	*5	15.25	*19.5	7
Borough of Richmond (Staten Is.)	9.75	*5	14.75	*18.5	7.35
Borough of Brooklyn	10	*5	15	*19	7
Albany, N. Y.	9.5	5	14.5	18	7.5
Binghamton, N. Y.	10.5	5	15.5	19	8.75
Buffalo, N. Y.	7	5	12	14	8
Jamestown, N. Y.	10	5	15	18.5	8
Plattsburg, N. Y.	10.5	5	15.5	19	8.5
Rochester, N. Y.	8	5	13	16	8
Syracuse, N. Y.	8.5	5	13.5	16	8.5
Danbury, Conn.	9.75	4	13.75	17.5	7.5
Hartford, Conn.	9.5	4	13.5	17	6.75
New Haven, Conn.	9.5	4	13.5	17	6.75
Bangor, Me.	10.5	5	15.5	19	8.5
Portland, Me.	10	5	15	18.5	7.5
Boston, Mass.	9.5	4	13.5	17	7
Concord, N. H.	10.5	5	15.5	19	8.25
Lancaster, N. H.	12	5	17	20.5	9.25
Manchester, N. H.	10	5	15	18.5	7.75
Providence, R. I.	8.5	3	11.5	14	7
Burlington, Vt.	11.5	5	16.5	20	8.5
Rutland, Vt.	11.5	5	16.5	20	9

*Plus 2% city sales tax computed at time of each sale.

Discounts to dealers: thru territory, except New York City, off normal s.s. price, 4c to undivided dealers, and 3.5c to "split" dealers. In metropolitan New York City, to undivided dealers, 4.75c; in Brooklyn, 4.5c; in Staten Island, 4.25c. Split dealers receive 0.5c less margin than undivided dealers.

To commercial consumers: Effective Feb. 4, 1935, covering yearly purchases, billed at posted tank car price, plus these differentials: 2.5c for delivery of 1,200 to 36,000 gals.; plus 2c, for 36,000 to 120,000 gals.; plus 1.5c for 120,000 to 240,000 gals.; plus 1c for 240,000 to 480,000 gals.; plus 0.5c for 480,000 gals. and over. Those buying less than 1,200 gals. yearly, get retail s.s. price.

Atlantic Refining

Atlantic White Flash Plus Gasoline

	Total T.W.	Taxes	Total T.W.	S.S.	Kerosine T.W.
Philadelphia, Pa.	11	5	16	18	9
Pittsburgh, Pa.	12	5	17	19	10
Allentown, Pa.	11.5	5	16.5	18.5	9
Erie, Pa.	11	5	16	18	8
Scranton, Pa.	11.5	5	16.5	18.5	10
Altoona, Pa.	12	5	17	19	9
Dover, Del.	11.5	5	16.5	18.5	10
Wilmington, Del.	9	5	14	14	9
Boston, Mass.	9.5	4	13.5	17	6.75
Springfield, Mass.	9.5	4	13.5	17	7.25
Worcester, Mass.	9.5	4	13.5	17	7.5
Fall River, Mass.	9.5	4	13.5	15	7
Providence, R. I.	9.5	3	12.5	14	7
Hartford, Conn.	9.5	4	13.5	17	6.75
New Haven, Conn.	9.5	4	13.5	7	6.75
Atlantic City, N. J.	9.5	4	13.5	17	9
Camden, N. J.	9.5	4	13.5	17	8
Trenton, N. J.	9.5	4	13.5	17	8
Annapolis, Md.	9.8	5	14.8	18.3	9.5
Baltimore, Md.	9.3	5	14.3	17.8	7.5
Hagerstown, Md.	9.5	5	14.5	14.5	10
Richmond, Va.	9.8	6	15.8	19.3	11.7
Wilmington, N. C.	9.3	7	16.3	19.8	11.4
Brunswick, Ga.	11	7	18	20	*14
Jacksonville, Fla.	10.5	8	18.5	20.5	10

Dealer discounts: on Atlantic White Flash Plus gasoline, thru territory, divided dealers, price equal to 3.5c off posted s.s. price; undivided dealers, price equal to 4c off posted s.s. price; authorized dealers contracts previous to Aug. 19, 1933, price equal to 3c less than posted s.s. price, plus 1c rental.

Discounts to commercial consumers: Consumer t.w. accounts billed at full t.w. price, with these discounts, effective Dec. 4, 1934, on yearly purchases: 1800 to 36,000 gals., 1.5c; 36,000 to 120,000 gals., 2c; 120,000 to 240,000 gals., 3c; 240,000 to 480,000 gals., 3.25c; 480,000 gals. and over, 3.5c. Those buying less than 100 gals. get retail s.s. price.

*Georgia kerosine has 1c state tax, not included in above prices.

S. O. Ohio

Sohio X-70 Gasoline

Ohio statewide	12	5	17	19	*12.5

Renown (Third Grade Gasoline)

Ohio statewide	11.5	5	16.5	17.5	....

Counties off statewide gasoline schedule: Butler, Champaign, Clark, Darke, Franklin, Greene, Hamilton, Miami, Montgomery, Preble and Summit: 12 | 5 | 17 | 19 | ....

Statewide Prices to Resellers & Agents

(These prices are on sliding scale based on actual spread between S. O. Ohio statewide tank car price and posted local s.s. price).

Including taxes	†Undivided Accounts	Divided Accounts	**Authorized Agents
Sohio X-70	15.5	16	16
Renown (3rd grade)	15	15.5	15.5

Note: On single deliveries of motor gasolines under 25 gallons, to t.w. consumers, s.s. price applies.

Sales tax: Ohio's 3% sales tax, effective Jan. 27, 1935, is added "where assessable, to regular posted prices", S. O. Ohio says.

*Kerosine prices include 1c state tax. Kerosine t.w. price in Hardin and Wyandot counties is 11.5c.

†Excluding authorized agents.

**Excluding 0.5c rental.

Discounts to contract tank wagon consumers only: on all motor gasolines, effective Dec. 1, 1934, off posted t.w. price, on deliveries per month: 1,000 to 9,999 gals., 1.5c per gal. 10,000 gals. and over, 2.5c. Under 1,000 gals., full t.w. price. Single deliveries of less than 25 gals., full s.s. price. Additional yearly discounts (less amount paid or credited to buyer on monthly purchases), off t.w. price: 12,000 to 119,999 gals., 1.5c; 120,000 gals. or over, 2.5c.

Discounts on kerosine: to dealers and commercial consumers, 3c per gal. off t.w. price, any quantity.

S. O. Kentucky

	Crown Gasoline T.W.	Taxes	Total T.W.	S.S.	Kerosine T.W.
Lexington, Ky.	13.5	6	19.5	21.5	10
Louisville, Ky.	12.5	6	18.5	20.5	10
Paducah, Ky.	12.5	6	18.5	20.5	10
Covington, Ky.	12	6	18	20	10.5
Jackson, Miss.	12	7	19	21	*11
Vicksburg, Miss.	12	7	19	21	*12
Birmingham, Ala.	13	*8	21	23	12
Mobile, Ala.	12	8	20	22	10
Montgomery, Ala.	13	*9	22	24	*15.5
Macon, Ga.	13	7	20	22	*13
Atlanta, Ga.	13	7	20	22	*12
Augusta, Ga.	13	7	20	22	*14
Savannah, Ga.	11	7	18	20	*13
Jacksonville, Fla.	10.5	8	18.5	20.5	10
Miami, Fla.	10.5	8	18.5	20.5	13.5
Tampa, Fla.	10.5	8	18.5	20.5	10
Pensacola, Fla.	10	*9	19	20	11.5

Kyso (Third Grade)

Lexington, Ky.	12.5	6	18.5	20	....
Louisville, Ky.	10.5	6	16.5	17.5	....
Paducah, Ky.	10	6	16	16.5	....
Covington, Ky.	10.5	6	16.5	18.5	....
Jackson, Miss.	10	7	17	18	....
Vicksburg, Miss.	10	7	17	18	....
Birmingham, Ala.	11	*8	19	20	....
Mobile, Ala.	10	*8	18	19	....
Montgomery, Ala.	11	*9	20	21	....
Atlanta, Ga.	9.5	7	16.5	17	....
Augusta, Ga.	9.5	7	16.5	17	....
Macon, Ga.	9.5	7	16.5	17	....
Pensacola, Fla.	8	*9	17	17	....

Dealer Discounts: off posted s.s. price, on Crown and Crown Ethyl gasolines to "undivided" dealers 4c; on Kyso, 3c. To "divided" dealers: Crown and Ethyl, 3.5c, and Kyso, 2.5c, all effective on or about Jan. 1, 1934.

Discounts to tank wagon consumers: all single deliveries of 25 gals. or less, get posted s.s. price: all single deliveries of 25 gals. or more, to be billed at posted t.w. price, plus following discounts, off posted t.w. price: Ethyl and Crown gasoline, 25 to 2,999 gals. monthly, 1.5c; Kyso, 1c; 3,000 to 24,999 gals., Ethyl and Crown, 2c; Kyso, 1.5c; 25,000 gals. or more, Ethyl and Crown, 3c; and Kyso, 2.5c.

**Taxes*: in the tax column is included these city and county gasoline taxes at the following points: Birmingham, 1c city; Mobile, 1c city; Montgomery, 1c city and 1c county; Pensacola, 1c city. Georgia and Mississippi kerosine prices include 1c state tax Montgomery kerosine price includes %c city tax.

Indiana

Standard Red Crown Gasoline

Chicago, Ill.	10	4	14	16	9.8
Decatur, Ill.	11.5	4	15.5	17.5	9.8
Joliet, Ill.	11.5	4	15.5	17.5	9.8
Peoria, Ill.	11.5	4	15.5	15.5	9.8
Quincy, Ill.	11.3	4	15.3	17.3	9.6
Indianapolis, Ind.	12.4	*5	17.4	19.4	‡14.5
Evansville, Ind.	12.2	*5	17.2	19.2	‡14.3
South Bend, Ind.	12.6	*5	17.6	19.6	‡12
Detroit, Mich.	9.5	4	13.5	15.5	9.3
Grand Rapids, Mich.	11.6	4	15.6	16.6	10.5
Saginaw, Mich.	12.8	4	16.8	18.8	9.3
Green Bay, Wisc.	12.2	5	17.2	19.2	10.5
Milwaukee, Wisc.	10.3	5	15.3	16.8	10.1
La Crosse, Wisc.	11.9	5	16.9	18.9	10.2
Minneapolis, Minn.	12.9	4	16.9	17.9	10.2
Duluth, Minn.	12.3	4	16.3	18.3	10.6
Mankato, Minn.	11.9	4	15.9	17.9	10.2
Des Moines, Iowa	11.3	4	15.3**	18.3	9.6
Sioux City, Iowa	11.5	4	15.5**	17.5	9.8
Davenport, Iowa	11.5	4	15.5**	17.5	9.8
Mason City, Iowa	11.7	4	15.7**	17.7	10
St. Louis, Mo.	11.2	†4	15.2	17.2	9.5
Kansas City, Mo.	10.9	†4	14.9	14.9	9.2
St. Joseph, Mo.	10.9	†4	14.9	16.9	9.2
Fargo, N. D.	12.9	4	16.9	18.9	11.2
Minot, N. Dak.	14.1	4	18.1	20.1	12.4
Huron, S. Dak.	12.4	*5	17.4	19.4	10.7
Wichita, Kans.	10.4	4	14.4	16.4	6.3

Note: Kerosine s.s. prices are generally 3c above normal t.w. price.

Above prices include these inspection fees on both gasoline and kerosine, per gallon, figured on basis of 50 gallons per barrel:

Alabama, 1/40c on gasoline, 1/2c on kerosine; Arkansas, 1/5c per gal. in a single barrel, 1/20c per gal. in bulk; Florida, 1/8c; Illinois, 3/100c; Indiana, 1/2c per gal. in a single barrel; 3/10c per gal. in lots of 2 to 10 bbls., 1/5c for 10 to 50 bbls., 2/25c for over 50 bbls.; Kansas, 1/50c, (3/50c can be charged to meet inspection department expenses); Louisiana, 1/32c; Minnesota, 1/25c; Missouri, 3/100c; Nebraska, 3/100c; Nevada, gasoline, 1/20c; North Carolina, 1/4c; North Dakota, 1/20c; Oklahoma, 2/25c per gal. in lots of more than 50 bbls., 1/5c in lots less than 50 bbls.; South Carolina, 1/8c; South Dakota, 1/10c; Tennessee 2/5c; and Wisconsin, 1/25c.

Kerosine inspection fee only: Iowa, 2/25c; Michigan, 4/5c per gal. for first 2 bbls.; 3/5c for next 3; 2/5c for next 5; 3/10c for next 15, and 1/5c per gal. in lots over 25 bbls.

TANK WAGON, SERVICE STATION MARKETS

Tax column includes 1c federal tax, state gasoline tax, also city and county taxes as indicated in footnotes, and inspection fees, as shown in general footnote. These prices in effect Nov. 18, 1935, as posted by principal marketing companies at their headquarters offices, but subject to later corrections.

S. O. Indiana (Cont'd)

Stanolind Gasoline (Third Grade)

Stanolind normal prices are 1c under normal Red Crown prices, thru territory. Among subnormal points are the following:

	Total T.W.	Taxes	T.W.	S.S.	Kerosine T.W.
Decatur, Ill.	10.5	4	14.5	16	....
Peoria, Ill.	10.5	4	14.5	14.3	....
Evansville, Ind.	11.2	*5	16.2	17.7	....
Indianapolis, Ind.	11.4	*5	16.4	18.1	....
Des Moines, Iowa	8.6	4	12.6**	17.3	....
Detroit, Mich.	8	4	12	14	....
Grand Rapids, Mich.	10.6	4	14.6	15.6	....
Milwaukee, Wis.	9.3	5	14.3	15.8	....
Huron, S. D.	11.4	*5	16.4	18.4	....
Wichita, Kans.	7.5	4	11.5	13.9	....

†St. Louis, Kansas City and St. Joseph prices include 1c city tax. ‡Includes 4c state tax.

*South Dakota gasoline and kerosine prices include 0.1c for sales tax. Indiana t.w. and s.s. gasoline prices include 0.2c for chain store tax.

**Service station prices for gasoline at Iowa points represent the opinion of National Petroleum News as to prices prevailing at the majority of stations.

Discounts to dealers: Effective Dec. 1, 1934, thru territory, except Michigan effective Apr. 1, 1935, and except Chicago division and Iowa, maximum discounts to controlled and uncontrolled undivided gasoline accounts, off s.s. price at normal points: Ethyl and Red Crown gasoline, 3.5c; Stanolind 2.5c; in Chicago, effective July 1, 1935, Ethyl and Red Crown, 4c; Stanolind, 3c. Divided gasoline accounts thru territory, get 0.5c less per gallon. In case of lease and agency and AAA accounts, the above discounts include the 0.5c per gal. rental allowance. In Iowa, normal dealer prices are 1.5c below normal t.w. price for first and second grade gasolines, and 0.5c under normal t.w. for third grade.

Discounts to commercial consumers: effective Jan. 1, 1935, thru territory, except Michigan effective Feb. 1, on purchases per month, discount off t.w. price; all gasolines, 25 to 1,000 gals., at t.w. price; 1,000 gals. or more, 1.5c off t.w. on Ethyl and Red Crown, and 0.5c on Stanolind. Purchases of less than 25 gals. get regular s.s. price.

S. O. Nebraska

Standard Red Crown Gasoline

Omaha, Neb.	11.9	5	16.9	18.9	10.1
McCook, Neb.	12.6	5	17.6	19.6	10.8
Norfolk, Neb.	12.3	5	17.3	19.3	10.5
North Platte, Neb.	12.7	5	17.7	19.7	10.9
Scottsbluff, Neb.	13.4	5	18.4	20.4	11.6

Reliance Gasoline (Third Grade)

Omaha, Neb.	10.5	5	15.5	15.5	....
McCook, Neb.	11.1	5	16.1	18.1	....
Norfolk, Neb.	11.3	5	16.3	18.3	....
North Platte, Neb.	11.7	5	16.7	18.7	....
Scottsbluff, Neb.	12.4	5	17.4	19.4	....

Discount to dealers: where service station gasoline prices are normal, resellers' allowance off service station prices are (*Maximum* over-all, including rent) as follows: Reliance, 2½c; Standard Red Crown, and Red Crown Ethyl, 3½c. Where service station gasoline prices are below normal, resellers' allowances are reduced one-half of the amount below normal, down to the following (*Minimum* over-all including rent): Reliance, 2c, Standard Red Crown and Red Crown Ethyl 3c.

Discounts to consumers: for tank wagon deliveries covered only by Standard Commercial Consumer Contract, effective January 1, 1935.

S. O. Louisiana

Essolene

	Consumer Tank Car	Dealer T.W.	Taxes	Posted S.S.	Kerosine T.W.
Little Rock, Ark.	7	9.5	7.5	20.5	11.5
Alexandria, La.	7	9.5	*8	21	*10.5
Baton Rouge, La.	7	9.5	*7	20	*11.5
New Orleans, La.	7	9.5	*8	21	*12
Lake Charles, La.	7.5	10	*8	21.5	*11
Shreveport, La.	6.5	9	*7	19.5	*9
Lafayette, La.	7.5	10	*8	21.5	*12.5
Bristol, Tenn.	9.1	10.35	8	21.1	14.5
Chattanooga, Tenn.	9.5	12	8	23.5	11.5
Knoxville, Tenn.	10	12.5	8	24	14
Memphis, Tenn.	8	10.5	8	22	9.5
Nashville, Tenn.	9	11.5	8	23	10

*Baton Rouge and Shreveport gasoline tax includes 5c state tax, 1c federal tax, and 1c parish tax. Alexandria, Lake Charles, Lafayette and New Orleans, 2c parish tax. Louisiana kerosine prices include 1c state tax; New Orleans kerosine includes also 1c parish tax.

Price basis to dealers: Undivided dealers get dealer price, less 0.5c.

Price basis to commercial consumers: Effective Feb. 11, 1935, commercial consumers not under contract will be billed at 2.5c per gal. above posted bulk plant tank car price at time and place of delivery in lots of 50 gals. or more at one time. Contract customers will be billed at following differentials over tank car price, on yearly purchases: up to 35,999 gals., 2.5c over tank car price; 36,000 to 119,999 gals., 2c over; 120,000 to 239,999 gals. 1.5c; 240,000 to 479,999 gals., 1c; 480,000 gals. and over, 0.5c.

On single deliveries to all classes of commercial consumers, of less than 50 gals., s.s. price at time and place of delivery applies.

Magnolia Petroleum

Mobilgas

	Total T.W.	Taxes	T.W.	S.S.	Kerosine T.W.
Muskogee, Okla.	11	5	16	18	8
Oklahoma City	11	5	16	18	8
Tulsa, Okla.	11	5	16	18	8
Fort Smith, Ark.	9.5	†5	14.5	18	8
Little Rock, Ark.	9.5	7.5	17	20.5	9.5
Texarkana, Ark.	10.5	*5	15.5	17.5	7
Dallas, Tex.	10	5	15	17	7
Ft. Worth, Tex.	10	5	15	17	7
Houston, Tex.	11	5	16	18	8
San Antonio, Tex.	11	5	16	18	8
El Paso, Tex.	12	5	17	19	10
Santa Fe, N. M.	13.5	**7	20.5	22.5	12
Roswell, N. M.	12.5	††6.5	19	21	10

Metro Gasoline (Third Grade)

Muskogee, Okla.	8	5	13	15	....
Oklahoma City	9	5	14	16	....
Tulsa, Okla.	9	5	14	16	....
Fort Smith, Ark.	9.5	5	14.5	16.5	....
Little Rock, Ark.	9.5	7.5	17	17	....
Texarkana, Ark.	7.5	5	12.5	14.5	....
Dallas, Tex.	7	5	12	14	....
Ft. Worth, Tex.	7	5	12	14	....
Houston, Tex.	8	5	13	15	....
San Antonio, Tex.	9	5	14	16	....
El Paso, Tex.	9	5	14	16	....
Santa Fe, N. M.	11.5	**7	18.5	20.5	....
Roswell, N. M.	10.5	††6.5	17	19	....

*In Texarkana, 4c Texas tax applies; outside Texarkana, 6.5c Arkansas tax applies.

†In Fort Smith, 4c Oklahoma tax applies outside Fort Smith, 6.5c Arkansas tax applies.

**Includes 1c city tax.

††Includes 0.5c city tax.

Note: *Price basis to dealers* off s.s. price in t.w., bulk or bbl. deliveries, on Mobilgas and Ethyl, normally: to 100% dealers, 4c; to divided dealers, 3.5c. On Metro gasoline in Texas, Oklahoma and New Mexico: to 100% dealers, 3c; to divided dealers 2.5c. On Metro, in Arkansas and Louisiana: to 100% dealers 3c.

Price basis to consumers: thru Texas, Oklahoma and New Mexico, except federal and state governments and political sub-divisions thereof; and also drainage, navigation and reclamation districts and road contractor accounts in Texas (in Texas all foregoing accounts receive same graduated discounts allowed 100% dealers, on all grades of gasoline, which see in above paragraph). All grades of gasoline invoiced at consumer's t.w. price, which normally is 2c less than s.s. price, less following contract quantity discounts at end of month, on monthly purchases: 3,001 to 10,000 gals., Mobilgas and Ethyl, 1c, Metro, 0.5c; 10,001 gals. and over, Mobilgas and Ethyl, 2c, Metro, 1c; 25 to 3,000 gals., no discount. Thru Arkansas and Louisiana, all grades gasoline invoiced at consumer's t.w. price, which on Mobilgas and Ethyl, normally is 3.5c less than s.s. price, less following contract quantity discounts at end of month, on all three grades, on monthly purchases: 3,001 to 10,000 gals., 0.5c; 10,001 to 20,000 gals., 1c; 20,001 to 40,000 gals., 1.5c; and 40,001 gals. and over, 2c. Metro invoiced at same price as Mobilgas.

Continental Oil

Conoco Bronze Gasoline

Denver, Colo.	13	5	18	20	11
Pueblo, Colo.	13	5	18	20	13
Grand Junc., Colo.	15.5	5	20.5	22.5	15
Casper, Wyo.	13.5	5	18.5	20.5	11.5
Cheyenne, Wyo.	13.5	5	18.5	20.5	13
Billings, Mont.	13.5	6	19.5	21.5	16.5
Butte, Mont.	15	6	21	23	17.5
Great Falls, Mont.	14.5	6	20.5	22.5	17.5
Helena, Mont.	15.5	6	21.5	23.5	17.5
Salt Lake City, Utah.	13	5	18	20	16
Boise, Ida.	16.5	6	22.5	24.5	18
Twin Falls, Ida.	17	6	23	25	18
Albuquerque, N. M.	13.5	†6.5	20	22	13

Continental Oil (Cont'd)

Demand (Third Grade)

	Total T.W.	Taxes	T.W.	S.S.	Kerosine T.W.
Denver, Colo.	11	5	16	18	....
Cheyenne, Wyo.	11.5	5	16.5	18.5	....
Helena, Mont.	13.5	6	19.5	21.5	....
Salt Lake City, Utah.	10	5	15	17	....
Boise, Ida.	14.5	6	20.5	22.5	....
Albuquerque, N. M.	11.5	†6.5	18	20	....

†Includes city tax of 0.5c.

Discounts: effective March 1, 1934, on gasolines, thru territory, off s.s. price: to "undivided" dealers: Ethyl and Conoco Bronze, 4c; Demand, 3c; to "divided" dealers: Ethyl and Conoco Bronze, 3.5c; Demand, 2.5c.

S. O. California

Standard Gasoline

San Francisco, Cal.	9.5	4	13.5	15.5	10
Los Angeles, Cal.	9	4	13	15	10.5
Fresno, Cal.	10.5	4	14.5	16.5	9
Phoenix, Ariz.	11.5	6	17.5	19.5	†16
Reno, Nev.	11.5	5	16.5	18.5	13
Portland, Ore.	10.5	6	16.5	18.5	13.5
Seattle, Wash.	10.5	6	16.5	18.5	13.5
Spokane, Wash.	13.5	6	19.5	21.5	16.5
Tacoma, Wash.	10.5	6	16.5	18.5	13.5

Flight Gasoline (Third Grade)

San Francisco, Cal.	8	4	12	14	....
Los Angeles, Cal.	7.5	4	11.5	13.5	....
Fresno, Cal.	8.5	4	12.5	14.5	....
Reno, Nev.	10	5	15	17	....
Phoenix, Ariz.	10	6	16	18	....
Portland, Ore.	9	6	15	17	....
Seattle, Wash.	9	6	15	17	....
Spokane, Wash.	12	6	18	20	....
Tacoma, Wash.	9	6	15	17	....

†Includes 5c state tax.

Discounts: on gasoline: on Stanavo Aviation, Standard Ethyl, and Standard gasolines, to 100% dealers, 2c below t.w. price; on Flight, 1c per gal. below t.w. To "split" dealers, all brands gasoline 1c below t.w.

Effective September 24, 1935, to commercial consumers: advance quantity discount from above prices extended at time of delivery, on Stanavo Aviation, Standard Ethyl and Standard gasolines, 2c per gal.; Flight, 1c.

On kerosine: tank car delivery, 3.5c off t.w. price to all classes of trade; transport truck and trailer deliveries, 3.5c below t.w. to resellers; plant deliveries to jobbers, 3c below t.w.

Canada

Prices of Imperial Oil Ltd.

Per Imperial Gallon, which is 1.2 U. S. Gallons

Imperial Three Star Gasoline

Hamilton, Ont.	16	6	21	23.5	16.5
Toronto, Ont.	16	6	21	23.5	16.5
Brandon, Man.	23.3	7	30.3	33.3	21.8
Winnipeg, Man.	21.7	7	28.7	31.7	20.2
Regina, Sask.	23	7	30	33	21.5
Saskatoon, Sask.	25.8	7	32.8	35.8	24.3
Edmonton, Alta.	25.2	7	32.2	35.2	23.7
Calgary, Alta.	22.5	7	29.5	32.5	21
Vancouver, B. C.	17.5	7	24.5	27.5	24
Montreal, Que.	14.5	6	20.5	23	17
St. John, N. B.	18	8	26	30	19.5
Halifax, N. S.	18	8	26	30	19.5

Discount to dealers and A.R.D. Accounts:

On gasoline, effective May 14, 1934: in Mari time Provinces, all dealers get 4c off s.s. price; in all o ther provinces, open dealers get 3c off s.s. price and 1c additional to 100% accounts, except Montreal C ty, Hamilton and Toronto, where open dealers get 2 5c off s.s. price with 1c additional to 100% accounts

Aviation Gasoline

Following are tank car and/or tank wagon prices of aviation gasoline in principal marketing territories (Stanavo aviation in all territories except Continental Oil and Magnolia Pet. Co.) Tax column includes 1c federal tax, and state tax; also municipal taxes as indicated in footnotes.

Effective Nov. 18, 1935

S. O. New Jersey

	Tank Car	T.W.
Bayonne, N. J.	9.75	12
Baltimore, Md.	9.75	12
Washington, D. C.	....	12.6
Richmond, Va.	....	13.5
Greensboro, N. C.	....	14.9
Raleigh, N. C.	....	14.6
Charleston, W. Va.	....	14.2

TANK WAGON, SERVICE STATION MARKETS

Tax column includes 1c federal tax, state gasoline tax, also city and county taxes as indicated in footnotes, and inspection fees, as shown in general footnote. These prices in effect Nov. 18, 1935, as posted by principal marketing companies at their headquarters offices, but subject to later corrections.

Colonial Beacon Oil Co.

	T.W.
Brooklyn, N. Y.	12.8
Buffalo, N. Y.	13.7
Boston, Mass.	13.5

S. O. Pennsylvania

Philadelphia, Pa.	14.1
Pittsburgh, Pa.	14.9

S. O. Louisiana

F.O.B. Tulsa	8.5

Prices in above four territories do not include state or federal taxes. They are for 73 octane grade aviation gasoline. An 80 octane product generally brings 0.5c premium and an 87 octane product, 1.5c premium over the 73 octane grade.

Note: S.s. prices in above four territories are generally 6c over t.w. prices. Following discounts apply for t.w. deliveries, on monthly purchases, off t.w. price: 3,000 to 10,000 gals., 0.5c; 10,000 to 20,000 gals., 1c; 20,000 to 40,000 gals., 1.5c; and over 40,000 gals., 2c. Consumer t.w. price is generally tank car price, plus freight, plus 2.5c per gal.

S. O. Ohio

	T.W.	Tax	Total T.W.
Thru Ohio: (To Commercial Consumers) Stanavo Ethyl Aviation (73 Octane):	15.5	5	20.5

Discounts: For delivery on contract to hangar operators and resellers: 2c below commercial consumer posted t.w. price.

S. O. Indiana

Chicago, Ill.	14.5	4	18.5
Indianapolis, Ind.	15.4	5	20.4
Detroit, Mich.	15.7	4	19.7
Milwaukee, Wisc.	14.8	5	19.8
Minneapolis, Minn.	14.9	4	18.9
St. Louis, Mo.	13.2	*4	17.2
Kansas City, Mo.	13.9	*4	17.9
Fargo, N. D.	15.9	4	19.9
Huron, S. D.	**15.4	5	20.4
Wichita, Kans.	13.4	4	17.4

*Includes 1c city tax.
**Includes 0.1c to cover sales tax.

Magnolia Petroleum

Dallas, Tex.	13	5	18

Humble Oil & Refining Co.

	Tank Car
Baytown, Tex. (exclusive of taxes)	8.2

Continental Oil Co.

	T.W.	Tax	Total T.W.
Denver, Colo.	16	5	21
Cheyenne, Wyo.	16.5	5	21.5
Helena, Mont.	19.5	6	25.5
Salt Lake City, Utah	18	5	23
Albuquerque, N. M.	16.5	*6.5	23

*Includes city tax of 0.5c.

S. O. California

Phoenix, Ariz.	14	6	20
Los Angeles, Cal.	11.5	4	15.5
San Francisco, Cal.	12	4	16
Reno, Nev.	13.5	5	18.5
Portland, Ore.	12.5	6	18.5
Seattle, Wash.	12.5	6	18.5
Spokane, Wash.	15.5	6	21.5

Note: For discounts, etc., see note under Standard and Flight gasoline above.

Naphtha

In Effect Nov. 18, 1935

(In Tank Wagon or Steel Barrels; in Cents per Gallon)

	Mineral Spirits	V.M.&P. Naphtha	Cleaner Naphtha	*Solvent
Altoona, Pa.	....	....	....	17
Baltimore (net)	11	....	....	11
Boston (net)	11	13	13	11
Bridgeport	....	....	....	13.5
Buffalo (net)	....	....	....	14
Chicago	15.7	16	15	15
Detroit	†17.4	†18.5	....	†18.5
Kansas City	13.4	14.4	14.4	13.4
Lancaster, Pa.	....	....	....	17
Milwaukee	18.3	†19.3	19.3	18.3
Minneapolis	†17.4	†18.4	†18.4	†16.9
Newark (net)	13	....	....	13
New York (net)	11	13	13	11
Philadelphia (net)	11.5	13	13	11.5
Providence (net)	11	11	....	11
Rochester (net)	‡12	....	....	‡12
St Louis	13.7	14.7	14.7	13
Syracuse	....	....	....	14

Petroleum Spirits (Solvent)

In Tank Cars (F.o.b. refinery or seaboard terminal)	
New York Harbor	9
Philadelphia district	9
Providence	9

Note: 2c off above t.w. prices to large buyers in some instances.

*In the East, prices apply on product generally known as Mineral Spirits; in the middlewest, prices apply on Stanosol (S. O. Indiana grade of Stoddard Solvent).

†At the following points, these taxes and/or discounts apply on the products specified: Detroit, first three products include 3c state tax, prices applying on 150 gals. or more, with prices 1c higher for less than 150 gals.; Milwaukee, V.M.&P. price includes 4c state tax; Minneapolis, first 3 products include 3c state tax; price for solvent for less than 100 gals. is 1c higher.

‡Purchases of at least 150 gallons.

Latest Changes

From Nov. 12 to Nov. 18 inclusive. Dates and amounts of changes shown. See table for full current prices. Changes are on gasoline unless kerosine is indicated.

Magnolia Petroleum—Metro:

El Paso, cut 1c, Nov. 15.

Kerosine:

Texarkana, cut 1c, Nov. 13.

Corrections

Notation of amount of change and dates not previously shown in table. Table in this issue is corrected to show these changes. Changes are on gasoline unless kerosine is indicated.

S. O. New Jersey—Essolene:

Washington, up 0.2c, Oct. 29 instead of cut as reported on page 61, Nov. 6th issue.

Aviation:

Baltimore, t. c. up 0.25c, Nov. 9.

S. O. New York—Mobilgas:

In the Nov. 7 general advance, the following points were unchanged: Binghamton, Buffalo, Rochester and Syracuse. New York City was unchanged this date, but was advanced 0.2c on Nov. 8. Binghamton, also, was advanced Nov. 9. Dealer t.w. and s.s. was advanced amounts indicated at the following points: 0.2c, Hartford, Jamestown and Manchester; 0.3c, Albany, Burlington, Concord, New Haven and Plattsburg; up 0.4c, Rutland; up 0.5c, Bangor, Boston, Lancaster, Portland and Providence. Danbury dealer t.w. up 0.4c, and s.s. up 1c.

Atlantic Refining—White Flash Plus:

Thru Connecticut, up 1c, due to state tax increase to 3c, Oct. 1.

Advance of 0.2c to 1.5c thru Massachusetts, Connecticut and Rhode Island, Nov. 8; Boston and Providence, up 0.5c; Springfield and New Haven, up 0.3c; Hartford, up 0.2c; Worcester, t.w. up 0.2c, s.s. up 1.5c; Fall River, t.w. up 0.3c, s.s. up 0.5c.

Wilmington, t.w. cut 2c and s.s. cut 4c, Oct. 29.

Continental Oil—Aviation:

Salt Lake City, up 2c, Nov. 4.

Fuel Oil Consumption Up 7 Per Cent in 1934

WASHINGTON, Nov. 19.—Domestic demand for gas oil and fuel oil in 1934 gained about 22,000,000 barrels, or about 7 per cent, over 1933, but was still well below the peak demand in 1929, according to a report today by the Bureau of Mines.

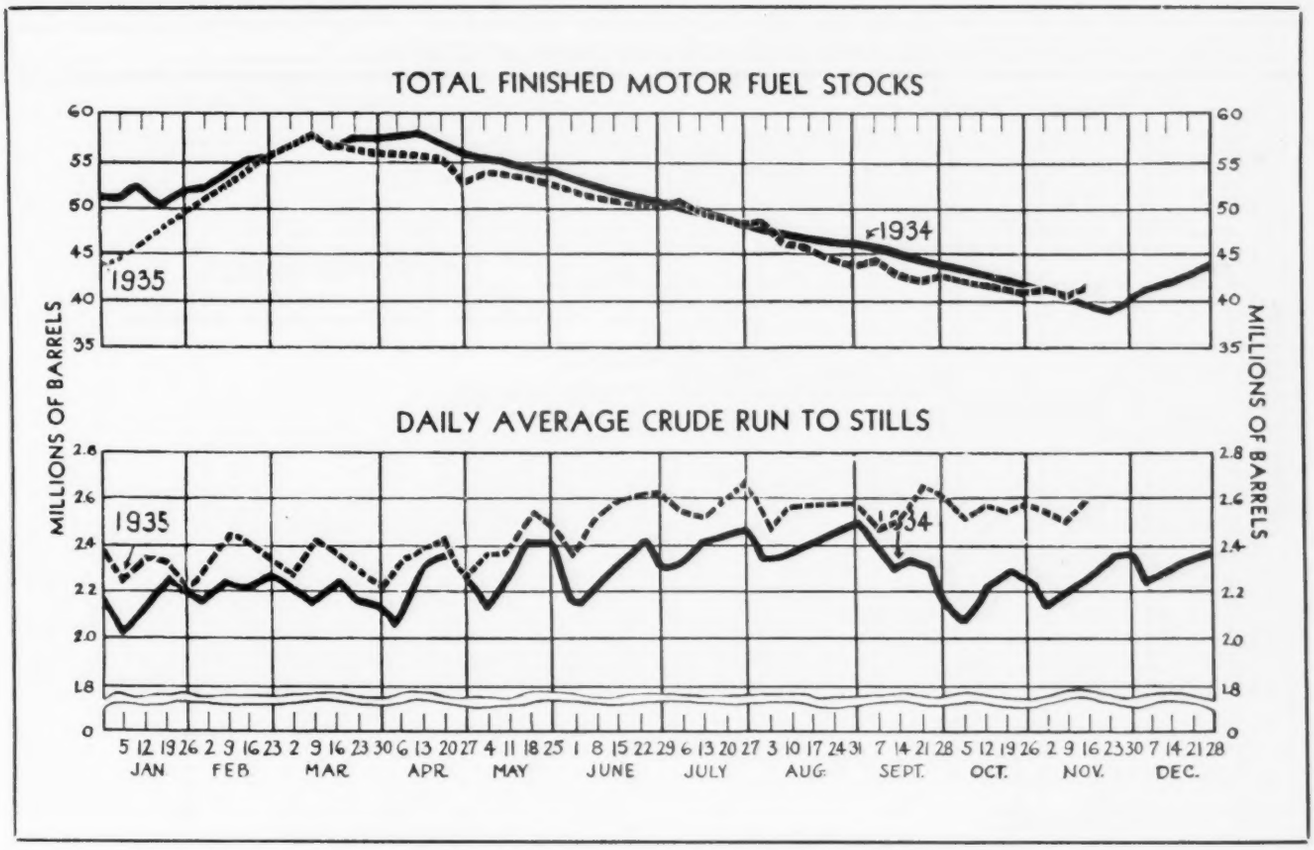
Industrial use of gas oil and fuel oil showed a substantial gain in 1934. But it was the 20 per cent increase in the use of heating oils and a 50 per cent gain in consumption of range oil which featured the report.

States with largest sales of gas oil and fuel in 1934 were: California 63,801,000 barrels; Texas 38,368,000 barrels; New Jersey 30,646,000 barrels; New York 30,367,000 barrels; Pennsylvania 21,871,000 barrels; Massachusetts 14,394,000 barrels; Illinois 13,206,000 barrels.

Principal purchasers and users of gas oil and fuel oil in 1934, with comparative figures for 1933, were:

Uses	1933 (Thousands of Barrels)	1934 (Thousands of Barrels)
Railroads	48,305	52,581
Steamships (including tankers)	70,445	69,262
Gas and electric power plants	22,507	23,143
Melters and mines	4,500	4,814
Manufacturing industries	47,000	52,128
Heating oils	50,140	60,822
U. S. Navy, Army transports, etc.	8,000	7,914
Used as fuel oil by oil companies	46,200	47,404
Miscellaneous uses	11,250	12,253
Total domestic sales	308,347	330,321
Export and other shipments	20,563	28,605
Total	328,910	358,926
Range oil	10,269	15,756

U. S. Crude Runs and Gasoline Stocks as Reported Weekly by A. P. I.


TOTAL FINISHED MOTOR FUEL STOCKS
1935
1934
MILLIONS OF BARRELS
DAILY AVERAGE CRUDE RUN TO STILLS
1935
1934
MILLIONS OF BARRELS
5 12 19 26 2 9 16 23 2 9 16 23 30 6 13 20 27 4 11 18 25 1 8 15 22 29 6 13 20 27 3 10 17 24 31 7 14 21 28 5 12 19 26 2 9 16 23 30 7 14 21 28
JAN FEB MAR APR MAY JUNE JULY AUG SEPT. OCT. NOV. DEC.

Refinery Crude Runs Increase 86,000 Barrels

(By Teletype)

NEW YORK, Nov. 19

AN INCREASE of 86,000 barrels in daily average crude runs to stills was accompanied by an increase of 931,000 barrels in bulk stocks of motor fuel the week ended Nov. 16, according to the American Petroleum Institute.

Crude runs totaled 2,592,000 barrels daily average the past week, compared with 2,506,000 barrels the previous week. Increases in the various districts ranged from 6,000 barrels each in Indiana-Illinois-Kentucky and Rocky Mountain to 59,000 barrels in the Texas Gulf plants. Only two districts showed decreases, which were small, and two districts showed no change over the previous week.

Bulk stocks of motor fuel totaled 51,697,000 barrels on Nov. 16 compared with 50,766,000 barrels on Nov. 9. Refinery stocks gained 496,000 barrels the past week to 25,152,000 barrels. In-transit and terminal stocks gained 285,000 barrels, to 16,409,000 barrels, and stocks of unfinished gasoline rose 265,000 barrels, to 5,316,000 barrels. Stocks of other motor fuels declined 115,000 barrels, to 4,820,000 barrels.

Total finished motor fuel stocks rose 781,000 barrels, to 41,561,000 barrels. The largest gains were in California, Oklahoma-Kansas-Missouri and Texas Gulf, where stocks gained 530,000 barrels, 195,000 barrels and 123,000 barrels respectively. Louisiana Gulf stocks declined 139,000 barrels.

Operations of reporting plants increased from 73.6 per cent of capacity in the week ended Nov. 9 to 76.1 per cent the past week.

Current Refinery Operations

Districts	Per Cent Capacity Reporting	Daily Average Crude to Stills (Barrels) Week Ended		Per Cent of Reporting Capacity Operated Week Ended		Stocks (Thousands of Barrels) Total Finished Motor Fuel*		Total Finished Motor Fuel*	Gas & Fuel Oil	Gas & Fuel Oil	Cracked Gasoline Production % Total Capacity Reporting	Daily Av. Production (Barrels) Week Ended	
		Nov. 16	Nov. 9	Nov. 16	Nov. 9	Nov. 16	Nov. 9	Nov. 16	Nov. 9	Nov. 9		Nov. 16	Nov. 9
East Coast	100.0	465,000	476,000	76.0	77.8	11,767	11,706	12,324	12,457		100.0	111,000	108,000
Appalachian	94.8	113,000	104,000	77.4	71.2	1,806	1,806	966	963		98.7	24,000	24,000
Ind., Ill., Ky.	95.9	365,000	359,000	86.1	84.7	7,014	7,103	4,011	4,079		99.7	108,000	109,000
Okla., Kans., Mo.	84.8	295,000	279,000	76.8	72.7	4,280	4,085	4,791	4,790		89.1	68,000	63,000
Inland Texas	48.5	95,000	91,000	59.4	56.9	1,129	1,072	1,617	1,606		70.9	25,000	25,000
Texas Gulf	96.4	568,000	509,000	95.5	85.5	5,024	4,901	11,091	11,511		98.5	133,000	128,000
La. Gulf	96.4	126,000	126,000	77.3	77.3	943	1,082	4,939	4,864		96.1	28,000	27,000
No. La., Ark.	90.0	42,000	42,000	58.3	58.3	221	222	514	505		95.7	7,000	7,000
Rocky Mt.	61.9	42,000	36,000	70.0	60.0	626	582	781	798		84.8	14,000	15,000
California	92.6	481,000	484,000	61.0	61.3	8,751	8,221	66,379	65,935		100.0	56,000	62,000
TOTAL	89.5	2,592,000	2,506,000	76.1	73.6	41,561	40,780	107,413	107,508		95.9	574,000	568,000

*Includes stocks at refineries, in bulk terminals, pipe lines and in transit.

SEABOARD MARKETS, Export *and* Coastwise

PRICES *DO NOT* INCLUDE FEDERAL TAX

Where $ mark is shown, prices are per barrel of 42 U. S. gallons.

Eastern Domestic

(Prices in cents per gallon tank car lots, unless otherwise noted, f.o.b. refinery or seaboard terminal, representing majority of sales and quotations to jobbers and/or consumers. Florida and S. Carolina inspection tax not included.)

*Motor Gasoline

Prices Nov. 18	60-64 Octane	65 Octane and Above
New York harbor	6.25	6.50
New York harbor, barges	6.00	6.25
Philadelphia district	6.25	6.50
Baltimore district	6.25	6.50
Norfolk district	6.25	6.50
Wilmington, N. C., district	6.25	6.50
Charleston, S. C., district	6.25	6.50
Savannah district	6.25 – 6.50	6.50 – 6.75
Jacksonville district	6.25 – 6.50	6.50 – 6.75
Portland district	6.25	6.50
Boston district	6.25	6.50
Boston district, barges	6.00	6.25
Providence district	6.00	6.50
Providence district, barges	5.75	6.25

*Due to lack of companies offering U. S. Motor gasoline, 59 octane and below in the open market, prices for this grade are discontinued. Quotations nominally are 0.25c below those for 60-64 octane grade.

Water White Kerosine

Prices Nov. 18			
New York harbor	5.00	Savannah district	5.50
N. Y. harbor, barges	4.875	Jacksonville district	5.50
Philadelphia district	5.25	Portland district	5.25
Baltimore district	5.25	Boston district	5.00
Norfolk district	5.25	Boston dist., barges	4.875
Wilmington, N. C.	5.25	Providence district	5.00
Charleston, S. C., dist.	5.25	Providence, barges	4.875

*Fuel Oils

Prices Nov. 18	New York harbor	New York harbor, barges	Philadelphia district
No. 1	5.00	4.875	5.25
No. 2	4.25	4.125	4.25
No. 3	4.25	4.125	4.25
No. 4	4.00	3.875	3.875
No. 5 (per barrel)	$1.15	.....	$1.15
No. 6 (per barrel)	$0.95	.....	$0.95

	Baltimore district	Boston district
No. 1	5.25	5.00
No. 2	4.25	4.25
No. 3	4.25	4.25
No. 4	3.875	4.00
No. 5 (per barrel)	$1.15	$1.25
No. 6 (per barrel)	$0.95	$0.95

	Boston dist., barges	Providence district	Providence dist., barges
No. 1	4.875	5.00	4.875
No. 2	4.125	4.25	4.125
No. 3	4.125	4.25	4.125
No. 4	3.875	4.00	3.875

*Fuel oils meet specifications of U. S. Commercial Standards CS12-35.

	Bunker Oil Grade C Per Barrel	Diesel Oil Ships' Bunker† Per barrel	Gas Oil 28-34 Gravity Per gallon	Diesel Oil Shore Plants Per gallon
New York harbor	*$0.95	*$1.65	4.00 – 4.25	4.00 – 4.25
Philadelphia dist.	*$0.95	*$1.65	4.25	....
Baltimore district	*$0.95	*$1.65	4.25	....
Norfolk district	*$0.95	*$1.65	4.25	....
Charleston district	$0.90	$1.65	....	....
Savannah district	$0.90	$1.65	....	4.50
Jacksonville dist.	$0.90	$1.65	....	4.50
Tampa district	$0.90	$1.65	....	....
Portland district	$1.05	$1.75	....	....
Boston district	$0.95	*$1.65	....	....
Providence district	$0.95	$1.65	....	....

*Lighterage for bunker oil, 5c per bbl. additional; for Diesel oil, 6.5c per bbl. additional.

Pacific Export

(Quotations are at seaboard, Los Angeles, in cargo lots, cents per gallon, except where otherwise noted.)

Prices—	Nov. 18	Nov. 11	Nov. 4
53-55 U. S. Motor	4.75 – 5.25	4.75 – 5.25	4.75 – 5.00
400 e.p. blend 65 Octane and above	5.00 – 6.00	5.00 – 6.00	5.00 – 5.50
38-40 w.w. kerosine, 150 fire point	4.25 – 5.00	4.25 – 5.00	4.25 – 5.00
41-43 w.w. kerosine	4.50 – 5.00	4.50 – 5.00	4.50 – 5.00
44 water white kerosine	5.00	5.00	5.00
Prime wh. kerosine	4.00 – 4.50	4.00 – 4.50	4.00 – 4.50
In Cargo lots, per barrel:			
Diesel fuel oil, above 23.9°	$1.10 –$1.15	$1.10 –$1.15	$1.10 –$1.25
Diesel fuel oil, under 23.9°	$1.05 –$1.15	$1.05 –$1.15	$1.05 –$1.15
30-34 gas oil	$1.10 –$1.15	$1.10 –$1.15	$1.10 –$1.15
Grade C fuel oil	$0.80 –$0.85	$0.80 –$0.85	$0.80 –$0.85
In Ships' Bunkers, or deep tank lots, per barrel:			
Diesel fuel oil, above 23.9 gravity	$1.125–$1.15	$1.125–$1.15	$1.275–$1.30
Diesel, under 23.9 gravity	$1.10 –$1.15	$1.10 –$1.15	$1.175–$1.20
Grade C fuel oil	$0.825–$0.85	$0.825–$0.85	$0.925–$0.95

Pacific Export (cont'd)	Nov. 18	Nov. 11	Nov. 4
Cased Goods:			
Gasoline, U.S. Motor	$1.40 –$1.50	$1.40 –$1.50	$1.40 –$1.50
Gasoline, 400 e.p. blend	$1.60 –$1.75	$1.60 –$1.75	$1.60 –$1.75
38-40 w.w. kerosine, 150 fire point	$1.15 –$1.30	$1.15 –$1.30	$1.15 –$1.30
Kerosine, prime white	$1.15 –$1.20	$1.15 –$1.20	$1.10 –$1.20

New York Export

(Prices in cents per gallon in barrels, F.a.s. New York)

Cylinder Oils (Pennsylvania Products)

	Nov. 18	Nov. 11	Nov. 4
Bright stock:			
Light, 25 pour point	26.00	26.00	26.00
Dark, 25 pour point	25.50	25.50	25.50
Neutral oil:			
200 3 color, 25 pour pt.	29.50	29.50	29.25
150 3 color, 25 pour pt.	25.00	25.00	24.50
600 Warren E filtered	20.00	20.00	20.00
600 stm. refd. unfiltered	16.50	16.50	16.50
650 stm. rfd. unfiltered	18.00	18.00	18.00
600 flash, steam refined	19.00	19.00	19.00
630 flash, steam refined	24.00	24.00	24.00

Wax Domestic *and* Export

(Prices in cents per pound. Tests made by A. S. T. M. methods. Melting points shown below, however, are A. M. P., 3° higher than A. S. T. M. (E. M. P.) melting points. Export prices are f.a.s. carload lots. Domestic prices are f.o.b. refineries in New York and New Orleans districts, in bags, carload lots, with 0.2c discount allowed for shipment in bulk).

	New York		New Orleans	
Prices—Nov. 18	*Domestic*	*Export*	*Domestic*	*Export*
124-6 Y.C. scale	2.25 – 2.30	2.25 – 2.30	2.25 – 2.30	2.25 – 2.30
122-4 W.C. scale	2.25 – 2.30	2.25 – 2.30	2.25 – 2.30	2.25 – 2.30
124-6 W.C. scale	2.25 – 2.35	2.25 – 2.35	2.25 – 2.35	2.25 – 2.35
123-5 Fully refined	4.20	3.625	4.20	3.625
125-7 Fully refined	4.30	3.75	4.30	3.75
128-30 Fully refined	4.55	4.00	4.55	4.00
130-2 Fully refined	4.80	4.25	4.80	4.25
133-5 Fully refined	*5.10	4.75	*5.10	4.75
135-7 Fully refined	*5.35	5.00	....	....

*Shipment either in bags or in bulk.

Gulf Coast

(Prices are f.o.b. Gulf oil terminals representing sellers' opinions except prices specified to the contrary. Prices cover bulk shipments of 20,000 barrels or more, unless otherwise noted.)

Motor Gasoline

For Domestic Shipment

Prices—	Nov. 18	Nov. 11	Nov. 4
59 octane and below	5.25	5.25	5.25
60-64 octane number	5.375– 5.50	5.375– 5.50	5.375– 5.50
65 octane and above	5.50 – 5.625	5.50 – 5.625	5.50

Fuel Oils

No. 1 Fuel oil	4.00	4.00	4.00
No. 2 Fuel oil	3.25	3.25	3.25
No. 4 Fuel oil	3.00	3.00	3.00

Kerosine

41-43 w.w.	4.00	4.00	4.00

Gasoline

For Export Shipment

U. S. Motor gasoline	5.125– 5.25	5.125– 5.25	5.125
60-62, 400 e.p. gasoline	5.125– 5.25	5.125– 5.25	5.125
61-63, 390 e.p. gasoline	5.25 – 5.375	5.25 – 5.375	5.25
64-66, 375 e.p. gasoline	5.50	5.50	5.375– 5.50
U. S. Motor, cases (cargoes)	$1.20 –$1.25	$1.20 –$1.25	$1.20 –$1.25
64-66, 375 e.p. cases (cargoes)	$1.25 –$1.30	$1.25 –$1.30	$1.25 –$1.30

Kerosine

44 water white	4.25	4.25	4.25
41-43 water white	3.875– 4.00	3.875– 4.00	3.875– 4.00
41-43 prime white	3.875	3.875	3.875
W.W., cases (cargoes)	$1.15 –$1.20	$1.15 –$1.20	$1.15 –$1.20
P.W., cases (cargoes)	$1.10 –$1.15	$1.10 –$1.15	$1.10 –$1.15

Gas and Bunker Oils

For Domestic and/or Export Shipment

*26-30 translucent gas oil	3.125– 3.25	3.125– 3.25	3.125– 3.25
*30 plus translucent gas oil	3.125– 3.25	3.125– 3.25	3.125– 3.25
*30 plus transp. gas oil	3.25	3.25	3.25
Diesel Oil Ships' bunkers	†$1.50	†$1.50	†$1.50
Grade C bunker oil, for ships' bunkers, per bbl.	†$0.80	†$0.80	†$0.80
Grade C bunker oil, per bbl. in cargoes	$0.70	$0.70	$0.70

*Less than ½ of 1% sulphur. †Lighterage 5c per bbl. additional.

(Continued on next page)

Seaboard Markets, Export *and* Coastwise

Where $ mark is shown, prices are per barrel of 42 U. S. gallons. ***Prices Do Not Include Federal Tax***

(Continued from preceding page)

Mexican Crude and Bunker Oils

(F.o.b. Steamer, Tampico)

Prices—	Nov. 18	Nov. 11	Nov. 4
Heavy Panuco crude taxes to be paid, per bbl.	$0.88 -$0.90	$0.88 -$0.90	$0.88 -$0.90
Grade C bunker oil, ships' bunkers, taxes paid, per bbl.	$0.80	$0.80	$0.80

Mid-Continent Lubricating Oils

(Prices in cents per gallon in bbls. f.a.s. Gulf terminals. In drums and new barrels, 0.5c to 1c higher per gal. in some instances.)

190-200 vis. D 210 brt. stk.	25.00	25.00	24.50
150-160 vis. D 210 brt. stk.:			
0-10 pour point	22.50	22.50	*22.00
10-25 pour point	22.00	22.00	22.00
25-40 pour point	21.50	21.50	21.50
150-160 vis. E 210 brt. stk.	21.50	21.50	21.50
120 vis. D 210 bright stock	21.00	21.00	21.00
180 vis. No. 3 color neutral oil:			
0-10 pour point	17.25 -17.50	17.25 -17.50	17.25 -17.50
15-30 pour point	16.25 -16.50	16.25 -16.50	16.25 -16.50
200 vis. No.3 color neutral oil:			
0-10 pour point	17.75 -18.00	17.75 -18.00	17.75 -18.00
15-30 pour point	16.75 -17.00	16.75 -17.00	16.75 -17.00
600 s.r. olive green	12.00 -12.50	12.00 -12.50	12.00 -12.50
600 s.r. dark green	10.00 -10.50	10.00 -10.50	9.25 -10.50
631 s.r.	15.50	15.50	15.50

*This price in effect Nov. 4

South Texas Lubricating Oils

(Viscosity at 100° F. pour test 0. Tanker, f.o.b. Gulf oil terminals, for export shipment)

Unfiltered Pale Oils:

Vis. Color			
100 No. 3	5.50 – 6.00	5.50 – 6.00	5.50 – 6.00
200 No. 3	6.375– 7.00	6.375– 7.00	6.375– 7.00

South Texas Lubricating Oils (cont'd)

Unfiltered Pales (cont'd)

Prices—	Nov. 18	Nov. 11	Nov. 4
300 No. 3	7.00 – 7.50	7.00 – 7.50	7.00 – 7.50
500 No. 3½	7.875– 8.50	7.875– 8.50	7.875– 8.50
750 No. 4	9.00 – 9.50	9.00 – 9.50	9.00 – 9.50
1200 No. 4	9.50 –10.00	9.50 –10.00	9.50 –10.00
2000 No. 4	9.75 –10.25	9.75 –10.25	9.75 –10.25

Red Oils:

Vis. Color			
100 No. 5-6	5.50 – 6.00	5.50 – 6.00	5.50 – 6.00
200 No. 5-6	6.125– 6.75	6.125– 6.75	6.125– 6.75
300 No. 5-6	6.75 – 7.00	6.75 – 7.00	6.75 – 7.00
500 No. 5-6	7.25 – 7.625	7.25 – 7.625	7.25 – 7.625
750 No. 5-6	9.00 – 9.50	9.00 – 9.50	9.00 – 9.50
1200 No. 5-6	9.50 –10.00	9.50 –10.00	9.50 –10.00
2000 No. 5-6	9.75 –10.25	9.75 –10.25	9.75 –10.25

Note: Red oil prices shown above cover oils with green cast; prices for blue cast red oils are slightly lower in some cases.

Tanker Rates

(Approximate tanker freight rates to Continental ports, in shipments per ton of 2240 pounds, British sterling: to U. S. ports, cents per barrel)

Rates—Nov. 18	Crude &/or Fuel Last Paid	Crude &/or Fuel Owners Ask	Refined Oil &/or Spirits Last Paid	Refined Oil &/or Spirits Owners Ask
Calif. U.K./Continent*	14/	15/-16/	15/	15/3-16/3
Gulf-U.K./Continent*	12/9	13/-14/	15/6	16/-17/
Calif.-N. Atlantic (not E. of N. Y.)	46c	50-52c	42c	48-50c
Gulf-N. Atlantic** (not E. of N. Y.)	†30c	†30-32c	32c	33–34c

Note: Dirty boat quotations are enlarged to cover, "Fuel and Light Crude" quotations.

*Continental ports in range between Bordeaux and Hamburg, both inclusive

**Venezuela loading same rate: Tampico 2c to 3c per bbl. additional.

†Rates for heavy crude or fuel 1c to 2c higher than for light crude.

Horse Drawn Tankwagon Gets Attention

BRIARCLIFF MANOR, N. Y.—Putting it back in the wagon may not be the newest wrinkle in delivering petroleum products but it is attracting plenty of attention for the Maue Oil Co. here.

Recently on a vacation in Wisconsin, W. G. Maue, proprietor, spotted a team of buff-colored Belgian horses which interested him so much that he bought the team, shipped it east, for use as an advertising medium in delivering fuel oil.

He dolled up the team in a specially made set of brass-studded harness and hitched it to what passes for an old-fashioned tank wagon made from an old auto truck chassis.

WWhen the horses get acclimated, they will be used for regular deliveries of fuel oil on short hauls. Right now they are making only light deliveries around Ossining, N. Y.

The horses have won prizes in various fairs. They have been named Beta and Theta, respectively for Mr. Maue's fraternity at Cornell, and for Mrs. Maue's sorority at the University of Wisconsin. The Maue Oil Co. owns several service stations here.

Weather Stimulates Light Fuel Oils, Heavy Grades Remain Unchanged

ARRIVAL of colder weather in much of the fuel oil consuming territory stimulated interest in the light fuel oils the week ended Nov. 16. The heavy grades were unchanged.

While colder weather was fairly general in the northerly sections of the country, reaction of fuel oil markets was rather spotty. Prices generally were steady to higher, but there was a pronounced element of bearishness which could not be overlooked.

On the eastern seaboard the increased activity was felt in the retail market rather than on the tank car market, although threats of higher tank car prices due to increased transportation costs caused a flurry of buying.

* * *

NEW YORK, Nov. 16.—Demand for light fuel oils showed more activity during the week ended Nov. 16 under the stimulus of advancing prices and colder weather. While the colder weather was reported to have helped the situation, this part of the activity was more noticeable on the retail end of the business.

Barge and tank car buyers of light fuel oil were spurred on to take heavier commitments by the possibility of further increases in their buying prices. Socony-Vacuum Oil Co. and a number of other prominent sellers in the northern portion of the eastern seaboard advanced their sales prices 0.25 cent on No. 2, 3 and 4 fuel oils. While these advances were not put into effect by all sellers up to the close of business on Nov. 16, buyers generally seemed to feel that the whole structure would be at the higher level early in the coming week, and hurried their purchases.

The expected advance in prices for bunker oil along the seaboard failed to materialize and suppliers buying this product at the Gulf and then reselling along the coast found themselves taking a loss, due to the high charter rates.

* * *

CHICAGO, Nov. 16.—The annual switching of interest of traders from gasoline to light fuel oil was gradually taking place in the Mid-Western tank car market the week ended Nov. 16.

Most sellers were anticipating higher prices in the near future for the Nos. 1, 2 and 3 oils. They base their contention on the fact that present lows for distillate and gas oils have been maintained throughout a period of extremely slow buying, and the colder weather should force onto the market a volume of orders that should presently exceed available supplies.

On the other hand, several sellers continued to assume a bearish attitude on tank car fuel oil markets. They believed that there is a potential threat on the stability of the light fuel oil markets contained in present refinery storage of this oil. As has happened previously, this storage material usually makes itself a definite market factor just about the time the market appears to be going places. Consequently, they reported they were trading with their fingers crossed.

The tightness of the Michigan crude situation was reflected somewhat in the light fuel market. The recent 10-cent a barrel advance has definitely backed up material into Michigan or eastern Wisconsin consumptive channels. What little Michigan distillate that had been moving around Chicago and into northern Indiana has seemed to have disappeared.

Heavy fuel oils were dull.

* * *

TULSA, Nov. 16.—Light fuel oils continued to maintain their favorable position in the Mid-Continent despite the lack of buying interest. Supplies available to open market purchasers were not large. Demand for No. 2 oil for use in burners was especially brisk.

Since there was little No. 2 oil available, refiners able to do so were blending this material from a No. 1 and 3 oil. In most cases, however, there were insufficient supplies of the No. 3 oil. This oil was expected to be freer in the near future. Up to now No. 3 oil has been used for rerun stock, but with a general curtailment in refinery runs, supplies should loosen up.

Cracking stocks were sluggish. Prices remained unchanged. Heavy fuel oil still was accumulating.

Fuel Oils

Following are tank wagon prices of various grades of heating oil at the points shown in various territories. Prices are in cents per gallon.

Prices In Effect Nov. 18, 1935

	No. 1	No. 2	No. 3	No. 4
S. O. New Jersey				
Newark, N. J.	7.5	6	6	6
Atlantic City, N. J.	8	6.5	6.5	6
Baltimore, Md.	7.5	5.5	5.5	5
Washington, D. C.	8	6.5	6.5	6.5

Discounts: At Newark and Atlantic City, purchasers taking 50,000 gals. get discount of 0.5c per gal.

Socony-Vacuum Oil Co., Inc.

	No. 1	No. 2	No. 3	No. 4
(S. O. New York Division				
New York City	7.25	6.25	6.25	5.75
Albany, N. Y.	7.5	6.5	6.5	6.5
Rochester, N. Y.	8.5	7	7	7
Boston, Mass.	7	6.25	6.25	6.25
Bangor, Me.	9.5	6.5	6.5	6.5
Manchester, N. H.	9	7.25	7.25	7.25
Burlington, Vt.	8.5	7	7	7
New Haven, Conn.	7.5	6	6	6
Providence, R. I.	7	6	6	6

Discounts: At New York City, consumers taking 10,000 to 50,000 gals., get 0.25c per gal. discount when minimum amount has been reached; above 50,000 gals., 0.5c

	No. 1	No. 2	No. 3	No. 4
Atlantic Refining				
Philadelphia, Pa.	6.50	5.50	....	5.5
Allentown, Pa.	9	7.5	7.5	7.5
Wilmington, Del.	8.5	7	....	6.5
Springfield, Mass.	8.75	7.25	....	7.25
Worcester, Mass.	8.75	7.25	....	7.25
Hartford, Conn.	8.5	7	....	7
S. O. Ohio				
Ohio Statewide	8	7.75	7.50	7.25

Note: S. O. Ohio prices are for hose dumps; bucket dumps are 0.5c per gallon higher.

S. O. Indiana

Stanolex Fuel Oil No. 1

Chicago	7
Indianapolis, Ind	*13.4
Detroit, Mich	7.5
Minneapolis, Minn	9.2
Sioux City, Ia	8.8
St. Louis, Mo	8.5
Kansas City, Mo	8.2

*Includes state tax of 4c.

Discounts: at Chicago above fuel oil prices apply on 150 gals. or more; 100 to 149 gals., 0.5c higher, under 100 gals., 1.5c higher. Indianapolis and Detroit 1c off t.w. price for deliveries of 100 gals. and over; at St. Louis, 1c off for 50 gal. dumps and over; at other above points, 1c off t.w. price for deliveries 150 gals. and over.

Sohio Introduces Oil In Cardboard Cans

CLEVELAND, Nov. 19. — A new Sohio motor oil, having one-third higher viscosity index than has previously characterized this leading Standard Oil Co. of Ohio brand, will be introduced through all of the company's stations and dealers Nov. 20.

The improved product makes its appearance in revolutionary containers of rolled cardboard, treated inside with an oil proof material and coated with high melting point paraffin for outside protection against weather and handling. They are sealed with tin ends and are being introduced in both quart and five-quart sizes.

A. M. Maxwell, vice-president of the Standard Oil Co. of Ohio, said the new packages will be easier to handle and more readily disposed of than other containers. Tall and slender, they are of distinctive appearance. Always within easy reach at the service station, they eliminate the need for measuring and make possible maximum speed of service.

CRUDE OIL MARKETS

Prices in $ per bbl. of 42 U. S. gals. at the well, A. P. I. gravity. Prices are effective as of 7 a.m. of dates as given.

Eastern Fields

Posted by Joseph Seep Purchasing Agency

(Effective Oct. 29, 1935, except Corning effective Oct. 2, 1935)

Penna. Grade Oil in Southwest Penna. Pipe Lines.....$1.87
Penna. Grade Oil in Eureka Pipe Lines (West Virginia).....$1.82
Penna. Grade Oil in Buckeye Pipe Lines (Macksburg, O.).....$1.67
Corning Oil in Buckeye Pipe Lines (Ohio)..$1.32

Posted by Other Companies

Tide Water Pipe Co., Ltd.:
Bradford-Alleghany district (Penna. and N. Y.) (Effective Oct. 29, 1935).....$2.15
*The Pennzoil Co.: (Effective Oct. 29, 1935)
Penna. Grade Oil in National Transit Lines*$2.12
Ashland Oil & Transportation Co.:
Somerset Oil in Ashland Lines (Ky.) (Effective May 20, 1935).....$1.13
*The Pennzoil Co. posts $2.12 in Cochran, Franklin, Hamilton and Doolittle, Pa. fields; prices in other districts range down to $2.07 per bbl. at well.

Michigan

(Posted by Pure Oil Co.)

Midland, Midland County (Nov. 7, 1935)...$1.12

(Posted by Simrall Pipe Line Corp.)

(Effective Nov. 7, 1935)

West Branch and equal grades.....$0.96
Beaverton, Crystal, Greendale, Porter and equal grades.....$1.12

Central States Fields

Posted by Ohio Oil Co.

Effective Feb. 1, 1935)
Lima.....$1.15
(Effective Jan. 5, 1934)
Princeton.....$1.13

(Effective May 22, 1935)
West. Kentucky $1.13
Illinois.....$1.13

Canadian Fields

Posted by Imperial Oil Refineries, Ltd.

Western Ontario

(Effective Sept. 9, 1933)

Petrolia.....$2.10
Oil Springs.....$2.17

Alberta—Turner Valley

(Prices f.o.b. field tankage)

Crude: (Effective Dec. 9, 1933)		Naphtha: (Effective May 21, 1934)	
40-44.9	$1.50	†Clear	$2.31
45-49.9	2.07	†Discolored	$2.55
(Effective May 21, 1934)			
50 and above	$2.19		

†Clear naphtha: 22 color; 10 lbs. vapor pressure, Reid method; 90% recovery; end point, 410°. Discolored naphtha: same specifications as for clear naphtha except color.

Mid-Continent

Posted by Stanolind Crude Oil Purchasing Co

(Effective Sept. 29, 1933)

(In Oklahoma-Kansas)		(In North-North Central Texas)
Below 29	$0.84	$0.79
29-29.9	0.86	0.81
30-30.9	0.88	0.83
31-31.9	0.90	0.85
32-32.9	0.92	0.87
33-33.9	0.94	0.89
34-34.9	0.96	0.91
35-35.9	0.98	0.93
36-36.9	1.00	0.95
37-37.9	1.02	0.97
38-38.9	1.04	0.99
39-39.9	1.06	1.01
40 and above	1.08	1.03

Above Stanolind prices met as follows:

Sept. 29, by The Texas Co. in Oklahoma, and in North and North Central Texas; Continental Oil in all three states; by Empire, White Eagle and Gypsy (Gulf).

See also Carter Oil, Magnolia, Humble schedules below and footnotes under Carter table.

Posted by Carter Oil Co.

(In Oklahoma and Kansas)

(Effective Sept. 29, 1933)

Below 25	$0.76	33-33.9	$0.94
25-25.9	0.78	34-34.9	0.96
26-26.9	0.80	35-35.9	0.98
27-27.9	0.82	36-36.9	1.00
28-28.9	0.84	37-37.9	1.02
29-29.9	0.86	38-38.9	1.04
30-30.9	0.88	39-39.9	1.06
31-31.9	0.90	40 and above	1.08
32-32.9	0.92		

Sept. 29, Carter gravity and price schedule met in Oklahoma-Kansas by Sinclair-Prairie, and Humble price schedule met in North-North Central Texas except that Sinclair-Prairie posts five lower grades down to below 25, with 2c differential for each. Same day, Shell Petroleum met Carter in full in Oklahoma-Kansas.

Posted by Magnolia Petroleum Co.

(Effective Sept. 29, 1933)

In Oklahoma, same schedule as Carter Oil, which see above, beginning with below 25, at $0.76 and ending with 40 & above, at $1.08.

In Texas: North and North Central, including Burkburnett, Archer, Stephens, Henrietta, Electra, Comanche and Olden; and in Central Texas, including Mexia, Wortham, and Panola county, same gravity and price schedule as Stanolind in Texas, which see above, beginning with below 29 at $0.79, and ending with 40 and above, at $1.03.

†Posted by Humble Oil & Refining Co.

(*In North, North Central and Central Texas)

(Effective Sept. 29, 1933)

Below 29	$0.79	35-35.9	$0.93
29-29.9	0.81	36-36.9	0.95
30-30.9	0.83	37-37.9	0.97
31-31.9	0.85	38-38.9	0.99
32-32.9	0.87	39-39.9	1.01
33-33.9	0.89	40 and above	1.03
34-34.9	0.91		

*Including North Texas, Ranger, Mexia, Powell, Boggy Creek, Richland, Wortham, Currie and Moran fields.

†Effective Dec. 1, 1934, Humble prices are based on 99% tank tables at 60F. Allowance or deduction of 1% is made for each 25° change in temperature above or below 60F.

Panhandle Texas

Posted by Humble Oil & Refining Co.

(Effective Sept. 29, 1933)

	Gray County	Carson-Hutchinson
Below 35	$0.79	$0.69
35-35.9	0.81	0.71
36-36.9	0.83	0.73
37-37.9	0.85	0.75
38-38.9	0.87	0.77
39-39.9	0.89	0.79
40 & above	0.91	0.81

Sept. 29, above prices met by Sinclair-Prairie, Magnolia and The Texas Co. in the entire area, also by Continental Oil in Carson-Hutchinson.

East Texas

(Effective Sept. 29, 1933)

Stanolind, Humble, Sinclair-Prairie, Texas and Magnolia.....$1.00

West Texas and New Mexico

Posted by Humble Oil & Refining Co.

(Effective Sept. 29, 1933)

Ector, Pecos and Winkler Counties, W. Texas and Lea Co., N. M.....$0.75
Crane, Upton, Crockett, Howard and Glasscock county, W. Tex.....$0.70

Sept. 29, Magnolia met in Crane, Upton, Howard, Glasscock, Mitchell and Winkler. Sept. 29, Texas Co. met Humble in Winkler, Crane, Upton and Lea counties; Stanolind Oil & Gas met in Hendrich field, Winkler county and posted in Marion county, Tex. below 25 at $0.63, plus 2c differential to 40 & above at $0.95.

South and Southwest Texas

Posted by Humble Oil & Refining Co.

(Effective Sept. 29, 1933)

Darst Creek	$0.87	Pettus	$1.05
Salt Flat	0.87	Tomball	1.15
(Effective June 29, 1935)			
Saxet	$0.80	Mirando	$0.75
(Effective Aug. 20, 1935)			
Anahuac (Chambers county) and Dickinson (Galveston county)			
30-30.9	$0.94	36-36.9	$1.06
31-31.9	0.96	37-37.9	1.08
32-32.9	0.98	38-38.9	1.10
33-33.9	1.00	39-39.9	1.12
34-34.9	1.02	40 & above	1.14
35-35.9	1.04		

Sept. 30, The Texas Co. met Humble in Darst Creek. On Sept. 29 it posted $0.80 in Duval county and $0.85 in Saxet-Greta.

Oct. 2, Magnolia posted $0.87 in Darst Creek and $1.15 in Tomball; Sept. 29 it posted $0.75 in Luling and $0.95 in Lytton Springs; on July 3, 1935, $0.75 for Mirando. Jan. 11, 1934 $1.00 for Cleveland, Liberty county, Tex.; Aug. 8, 1935, $0.93 in Hardin, Liberty county, Tex.

Posted by Humble

Conroe ***(Montgomery Co., Tex.)***

(Effective Sept. 29, 1933)

35-35.9	$1.09	38-38.9	$1.13
36-36.9	1.11	39-39.9	1.17
37-37.9	1.13	40 & above	1.19

Sept. 30 Texas Co. met above prices.

North Louisiana-Arkansas

Posted by Standard Oil Co. of Louisiana

(Effective March 17, 1934, except Homer, Smackover and Nevada county, Sept. 29, 1933).

(In Caddo, Homer, Haynesville, Sabine, De Soto, Sarepta, Carterville, El Dorado and Miller county).

Below 25	$0.71	33-33.9	$0.89
25-25.9	0.73	34-34.9	0.91
26-26.9	0.75	35-35.9	0.93
27-27.9	0.77	36-36.9	0.95
28-28.9	0.79	37-37.9	0.97
29-29.9	0.81	38-38.9	0.99
30-30.9	0.83	39-39.9	1.01
31-31.9	0.85	40 and above	1.03
32-32.9	0.87		

Smackover, Ark.....$0.70
Nevada, Ark.....0.60
Urania, La. (La. Oil Refg. Co., Jan. 1, '34)... 0.87

*Gulf Coastal Fields

Posted by Humble Oil & Refining Co.

(Effective Sept. 29, 1933)

Below 20	$0.82	27-27.9	$0.98
20-20.9	0.84	28-28.9	1.00
21-21.9	0.86	29-29.9	1.02
22-22.9	0.88	30-30.9	1.04
23-23.9	0.90	31-31.9	1.06
24-24.9	0.92	32-32.9	1.08
25-25.9	0.94	33-33.9	1.10
26-26.9	0.96	34 and above	1.12

Refugio heavy (Effective June 29, 1935).....$0.80

Effective Dec. 1, 1934 Humble prices are based on 99% tank tables at 60 F. Allowance or deduction of 1% is made for each 25° change in temperature above or below 60 F.

*Includes these fields: Barbers Hill, Goose Creek, Hull, Humble, Liberty, Moss Bluff, Orange, Pierce Junction, Rabbs Ridge, Raccoon Bend, Refugio light, Sour Lake, Spindletop, Sugarland, and West Columbia.

Above prices met Sept. 29 by Sinclair-Prairie and Sun Pipe Line Co.

Posted by The Texas Co.

(Effective Sept. 30, 1933)

Same gravity and price schedule as Humble up to 30-30.9 gravity, which see; plus these grades:

30-30.9	$1.04	36-36.9	$1.10
31-31.9	1.05	37-37.9	1.11
32-32.9	1.06	38-38.9	1.12
33-33.9	1.07	39-39.9	1.13
34-34.9	1.08	40 and above	1.14
35-35.9	1.09		

Partlavaca (Tex. Gulf effective May 17, 1935).$0.80

Rocky Mountain Fields

Posted by Stanolind Oil & Gas Co.

(Effective Sept. 29, 1933)

Salt Creek and Dutton Creek, Wyo. Same schedule as Stanolind posts in Oklahoma-Kansas which see on first crude price page.

Elk Basin, light.....$1.18
Grass Creek, light.....1.18
Grass Creek, heavy.....0.62
Greybull-Torchlight.....1.18
Iles, light, Col.....0.90
Iles, heavy.....0.90
Hogback, N. M.....1.11
Frannie light (Effective May 1, 1934).....0.70
Frannie heavy.....0.62

Posted by Ohio Oil Co.

(Effective Sept. 29, 1933)

Elk Basin, Wyo.....$1.18
Grass Creek, light.....1.18
Rock Creek.....1.02
Big Muddy.....1.01
†Sunburst, Mont. (Effective July 19, 1935)... 1.20

†Met by Texas Co. July 19.

Posted by *International Refining Co.

(Effective May 23, 1934)

Cutbank, Mont.....$1.45

*Texas Co. subsidiary.

(Continued on next page)

Interesting TRADE ITEMS

Absolute Pressure Gauge

The Foxboro Co., Foxboro, Mass., announces the development of a new gauge to measure absolute pressure. This instrument has a method of compensating for changes in barometric pressure that is comparable with the manometer method of measuring differential pressure. Two hydrons, one measuring direct pressure and the other barometric pressure are so connected that their pressures directly oppose each other. The compensating hydron which is sealed under full vacuum exactly counterbalances the barometric effect on the main pressure hydron.

The gauge is protected against overrange, is light and portable, and contains no liquid to spill or lose its seal.

* * *

Announcement of the appointment of C. L. Welch, Lee S. Abbott and George E. Fox, as district managers, is made by A. E. Heroux, general manager of the paint division of Aluminum Industries, Inc., Cincinnati, manufacturer of Permite Aluminum paint.

Welch will contact the trade in Minnesota, Wisconsin, Michigan, Indiana, Illinois and Ohio and will have offices in Chicago. Abbott, with an office in Tulsa, will cover the oil producing states, and Fox, from New York, will be active on the Atlantic seaboard and the eastern states.

* * *

Lubricator

The United States Air Compressor Co., Cleveland, will feature a new line of lubrication equipment at the Atlantic City Automotive Service Industries Show, which will be known as "Original Container Lubricators." The new design eliminates a chain hoist or block and tackle said to be often used when inserting a new drum of grease. The attendant merely presses a button, which releases and raises cover, pump and suction pipe out of the container shell so that the empty drum can be quickly removed and a new one inserted.

* * *

Glass Building Block

Development of an improved glass-block for building purposes, which has stood up under pressures of 72,500 pounds to a single block and which reduces heat flow, deadens sound, transmits and diffuses light, deflects sun glare and resists fire is announced by Owens-Illinois Glass Co., Toledo. Production is going forward at Muncie, Ind.

Official announcement of the new development followed the completion of exhaustive tests conducted by the engineering department of Purdue University where the blocks are to be used partially in the construction of a building to house research development.

* * *

An interesting story of research and development in the refractory cement business has just been published by Johns-Manville in booklet form. In the booklet the term "mighty midget" has been applied to refractory cement because of the value it gives as compared to the volume used. Each phase of the story is supplemented by photographs of the materials in use and of laboratory scenes. In addi-

CRUDE OIL MARKETS

Continued from preceding page

CALIFORNIA, Posted by Standard Oil of California

*All gravities above those quoted take highest price offered in the field. Effective * Nov. 1, 1935*

Gravity	Signal Hill	Seal Beach Alamitos Heights	Huntington Beach	Inglewood	Playa Del Rey	Olinda-Brea Canon	Athens-Rosecrans Dominguez	Elwood Terrace	Torrance	Richfield	Whittier-La Habra	Montebello	Coyote Hills	Santa Fe Springs	Newhall McKittrick Kern River	Mountain View	Midway Sunset Elk Hills Buena Vista Hills	Lost Hills	Coalinga	Wheeler Ridge	*Santa Paula (Union Oil Co.)	*Orcutt (Union Oil Co.)
14-14.9	$0.75	$0.74	$0.73	$0.74	$0.75	$0.71	....	....	$0.75	$0.71	$0.71	$0.72	$0.72	....	$0.65	....	$0.65	$0.65	$0.65	....	$0.65	$0.65
15-15.9	.75	.74	.73	.74	.75	.71	....	....	.75	.71	.71	.72	.72	....	.65	....	.65	.65	.65	....	.65	.65
16-16.9	.75	.74	.73	.74	.75	.71	....	....	.75	.71	.71	.72	.72	....	.65	....	.65	.65	.65	....	.65	.65
17-17.9	.75	.74	.73	.74	.75	.71	....	....	.75	.71	.71	.72	.72	....	.65	....	.65	.65	.65	....	.65	.65
18-18.9	.75	.74	.73	.74	.75	.71	....	....	.75	.71	.71	.72	.72	....	.65	....	.65	.65	.65	....	.65	.65
19-19.9	.75	.74	.73	.74	.75	.71	....	....	.75	.71	.71	.72	.72	....	.65	$0.65	.65	.65	.65	$0.65	.65	.65
20-20.9	.75	.74	.73	.74	.75	.71	....	....	.75	.71	.71	.72	.72	....	....	.65	.65	.65	.65	.65	.65	.65
21-21.9	.75	.74	.73	.74	.76	.71	....	....	.75	.71	.71	.72	.72	$0.73	....	.65	.66	.67	.65	.65	.65	.65
22-22.9	.75	.74	.73	.75	.78	.72	....	....	.75	.71	.71	.72	.72	.73	....	.65	.67	.68	.66	.65	.65	.65
23-23.9	.75	.74	.74	.76	.79	.73	$0.75	F.O.B. Ship	.76	.71	.72	.73	.72	.73	....	.65	.69	.70	.67	.65	.65	.65
24-24.9	.77	.74	.75	.77	.81	.74	.75	....	.77	.72	.74	.74	.73	.73	....	.65	.71	.71	.69	.65	.65	.65
25-25.9	.78	.75	.76	.78	.82	.75	.76	....	.78	.73	....	.75	.74	.73	....	.66	.72	.73	.70	.66	.66	.65
26-26.9	.79	.76	.78	.79	.83	.76	.77	....	.79	.74	....	.76	.75	.73	....	.67	.74	.74	....	....	.66	.66
27-27.9	.80	.78	.79	.80	F.O.B. Standard Pipe Line	.77	.79	....	....	.75	....	....	.77	.74	....	.68	.76	.76	....	....	.67	....
28-28.9	.81	.79	.80	.81		.79	.80	....	....	.76	....	....	.78	.75	....	.70	.77	.77	....	....	.67	....
29-29.9	.82	.81	.81	.82		....	.82	....	....	.78	....	....	.79	.77	....	.71	.79	.78	....	....	.68	....
30-30.9	.83	.83	.82	.83		....	.83	....	....	....	....	....	.80	.78	....	.72	.81	.80	....	....	.69	....
31-31.9	....	....	....	.84		....	.84	....	....	Kettleman Hills			.81	.79	....	.74	.83	....	....	....	....	....
32-32.9	....	....	....	.85		....	.86	....	....				.82	.81	....	.75	.84	....	....	....	....	....
33-33.9	....	....	....	....		....	....	$0.84	....	....	$0.81	....	.83	.82	....	.76	.86	....	....	....	....	....
34-34.9	....	....	....	....		....	....	.85	....	....	.83	....	.85	.83	....	.77	....	....	....	....	....	....
35-35.9	....	....	....	....		....	....	.86	....	....	.84	....	....	.85	....	....	....	....	....	....	....	....
36-36.9	....	....	....	....		....	....	.88	....	....	.86	....	....	.86	....	....	....	....	....	....	....	....
37-37.9	....	....	....	....		....	....	.89	....	....	.87	....	....	.87	....	....	....	....	....	....	....	....
38-38.9	....	....	....	....		....	....	....	....	....	.88	....	....	.89	....	....	....	....	....	....	....	....
39-39.9	....	....	....	....		....	....	....	....	....	.90	....	....	....	....	....	....	....	....	....	....	....

*Union Oil prices effective Nov. 5, 1935. Union Oil prices in fields where it purchases meets all above Standard prices, except that it posts up to 40-40.9 gravity on Athens-Rosecrans-Dominguez, beginning with $0.87 for 33-33.9, plus 1c differential, to 40-40.9 at $0.94; and it posts three lower grades on Kern River-McKittrick-Mt. Poso as follows: 11-11.9, $0.59; 12-12.9, $0.61; and 13-13.9, $0.63.

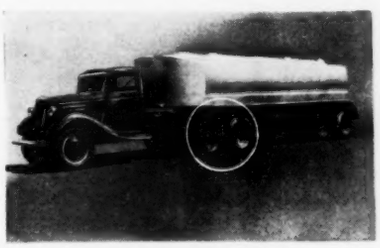
tion, a brief description of the various everyday uses of the several kinds of refractories is presented.

Copies of the booklet, entitled "Fire Tamers" may be obtained by writing to the New York office, 22 E. 40th St.

* * *

Four Rear Wheel Drive Truck

Interest is being aroused by a new unit for Ford and Chevrolet 1½-ton trucks which is said to enable them to carry payloads comparable to those of heavy duty trucks, yet maintain the much lower, light truck economy. It is known as the Thornton Dual Ratio Four Rear Wheel Drive, made by Thornton Tandem Co., 5131 Braden St., Detroit. Initial costs are cut 35



to 50 per cent by this equipment, it is alleged.

The secret of greater driving power is said to be in the location of the power transfer case—midway of the two driving axles. And the transfer case gearing doubles the speed in the truck transmission case, providing eight speeds forward, two reverse.

Among other advantages reported is a correct wheelbase for every body length and type. The forward driving axle follows the lead of the front wheels, allowing the truck to turn directly from a flush curb contact, and to turn back as easily as the conventional two-wheel drive truck of the same wheel base.

* * *

Metal Cleaning Handbook

Prepared to briefly explain the general principles of modern metal cleaning, "The Metal Cleaning Handbook" by R. W. Mitchell recently published by The Magnus Chemical Co., Garwood, N. J., explains in considerable detail the procedure, methods, equipment, and cleaning materials for the various types of cleaning operations. While the book is intended to be somewhat in the nature of a handbook for reference purposes, it has few specific directions but suggests the availability of the Magnus Laboratory as the service department in solving any particular problem.

The book, which contains over 200 pages, is profusely illustrated with pictures and diagrams. In the appendix is miscellaneous data on pertinent subjects. There is also included a buyers' index. The price of the book is $1.

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- LIBERAL PROFITS

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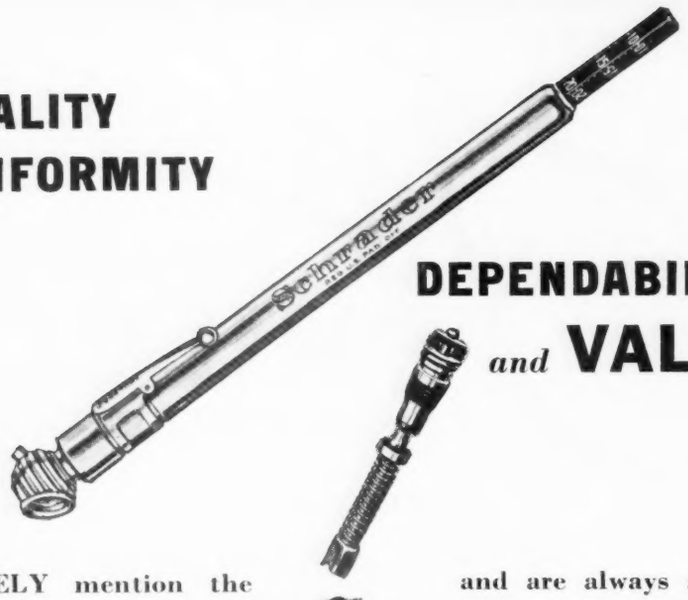
NAME .....

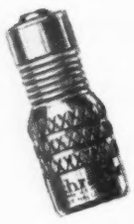
St-Box ..... City-State .....

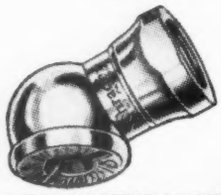
Company ..... Position .....

QUALITY
UNIFORMITY



DEPENDABILITY
and **VALUE**





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"Petroleum and Its Products" is a book which is especially important to the man in refining.

It is a thorough chemical discussion of the properties, refining and utilization of petroleum. Written by Wm. A. Gruse, Ph. D. of the Mellon Institute of Industrial Research, who has spent several years in physical and chemical research in petroleum.

The work is divided into three sections: (1) description of important types of petroleum, its origin, physical properties, constitution from a chemical standpoint, including hydrocarbon and non-hydrocarbon constituents. (2) Distillation, sefining and treating by chemical methods, and by physical methods such as absorption and cracking. (3) Under "utilization" the author discusses gasoline and other motor fuels; kerosene, lubrication and petroleum lubricants, wax and petrolatum, fuel oil, petroleum asphalts and miscellaneous by-products.

770 *pages, price* $4.50. *Send check for your copy today!*

NATIONAL PETROLEUM NEWS, 1213 West 3rd St., Cleveland, Ohio

On The Lazy Bench

"Coise it! Coise it!" hissed the villain, snatching at the girl's waist.

"No, it ain't either!" she retorted. "It's a girdle."

—The Armstrong Trap, Armstrong Machine Works

—NPN—

Taken Literally

The wife was working out a crossword puzzle. Suddenly she turned to her husband and asked:

"What is a female sheep?"

"Ewe," he replied.

And that started the unpleasantness that spoiled the whole evening.

The Naft—Anglo-Iranian Oil Co.

—NPN—

Like Mother

Mrs. Blupe: "Did you see the Smith twins?"

Blupe: "Yes."

The Mrs.: "Don't you think the boy is a picture of his father?"

Blupe: "I sure do—and the girl is a talky of her mother."

—The Pure Oil News, The Pure Oil Co.

—NPN—

Practically His Own Boss

Mr. Smith: "So your new job makes you independent?"

Visitor: "Absolutely! I get to the office any time I want to before eight and leave just when I please after five."

—The Unloading Rack, A. Y. McDonald Mfg. Co.

—NPN—

"I can't marry him, mother; he's an atheist, and doesn't believe there is a hell."

"Marry him, my dear, and between us we'll convince him he's wrong."

—The Armstrong Trap, Armstrong Machine Works

—NPN—

Putting on White Airs

As the colored doorman ran down to open the limousine door, he tripped and rolled down the last four steps.

"For heaven's sake, be careful," cried the club manager. "They'll think you're a member."

—The Unloading Rack, A. Y. McDonald Mfg. Co.

—NPN—

Employer (to new office-boy): Has the cashier told you what you have to do in the afternoon?"

New Boy: "Yes, sir, I was to wake him up when I saw you coming."

The Naft—Anglo-Iranian Oil Co

—NPN—

Improving

Two old maids were in an insane asylum for years, always knitting and knitting.

"Gee," sighed Mayme one day, "I wish some tall, handsome man would wind

his arms around me and squeeze me until I gasp."

"Now you're talking sense," from Jayne. "You'll be out of here in a few days."

—The Pure Oil News, The Pure Oil Co.

—NPN—

The young lady walked boldly up to a woman whom she took to be the matron of the hospital.

"May I see Lt. Barker, please?" she asked.

"May I ask who you are?"

"Certainly, I am his sister."

"Well, well. I'm glad to meet you. I'm his mother."

—Marquette Lubricator, Marquette Petroleum Products, Inc.

—NPN—

Little Albert came home from school with a new book under his arm. "It's a prize, Mother," he said.

"A prize? What for, dear?"

"For natural history. Teacher asked me how many legs an ostrich had and I said three."

"But an ostrich has two legs."

"I know that now, Mother, but the rest of the class said four; and I got the prize."

—The Armstrong Trap, Armstrong Machine Works

—NPN—

"Where is the head bookkeeper?"

"He has gone to the races."

"What! In the midst of our annual audit?"

"Yes, sir. It was our only chance to balance the books."

The Naft—Anglo-Iranian Oil Co.

—NPN—

Stranger to Old Mammy: "An alligator just swallowed one of your children."

Mammy (calmly filling her pipe): "Well, suh, Ah wouldn't be surprised. Ah was tellin' Rastus las' night sompin mus' be gettin' dem kids."

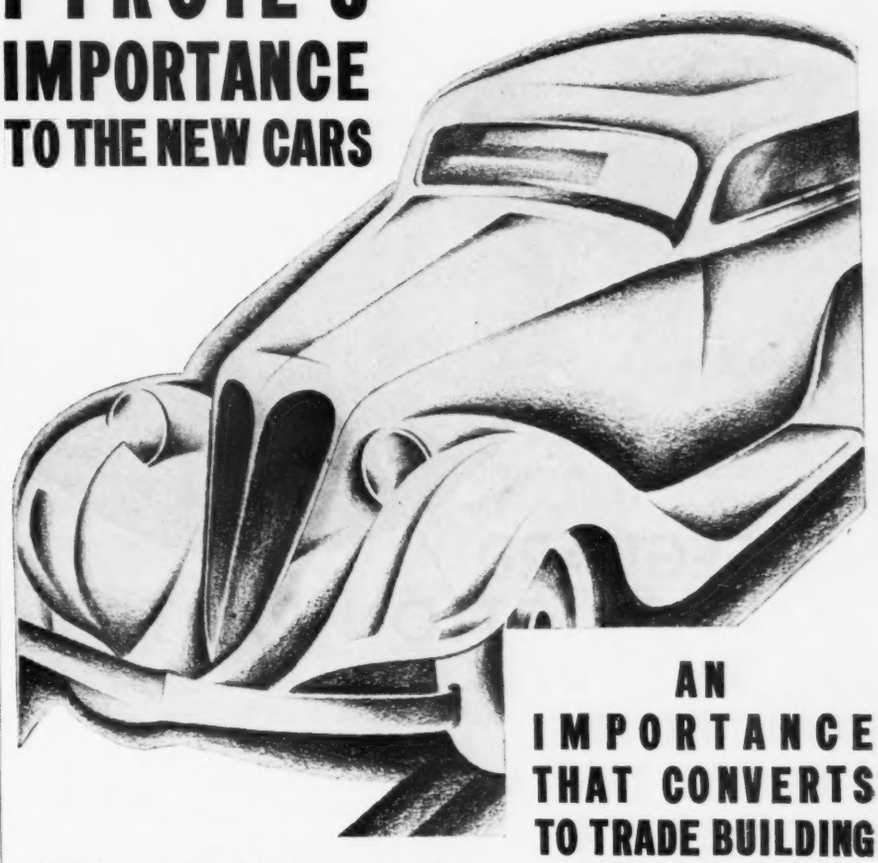
—The Pure Oil News, The Pure Oil Co.

—NPN—

BRIGHT SAYINGS

The Sunoco Diamond

PYROIL'S IMPORTANCE TO THE NEW CARS



When Customers Drive in for Gas, Oil, or Grease, Simply Ask "PLAIN OR PYROIL TREATED?"—a Service that Brings Added Profits and Much Good Will!

AN IMPORTANCE THAT CONVERTS TO TRADE BUILDING AND PROFIT

Many of the new cars are this year equipped with bearings or pistons constructed with alloy metals (cadmium-silver, copper-lead, etc.). Here is where Pyroil—world wide selling lubrication process—comes in for an unusual efficiency.

We have just released some interesting chart and photo-micrographic material direct from the technical and metallurgical laboratory, which AGAIN proves that cars—new and old—protected with Pyroil should enjoy longer life, increased power and performance, less trouble and a definite economy of operation. This will be found of genuine importance and will be sent Free on request. Mail coupon below at no obligation.

Genuine Pyroil (patent protected and nationally advertised—see Saturday Evening Post, November 9, 1935) proves of definite aid in building sales of gasoline, oil, grease, and of companion products. Let us give you these facts also. Mail the coupon—or see 'phone book for nearest Distributor. Manufactured and Guaranteed by Pyroil Company, W. V. Kidder, Pres., 1873 LaFollette Ave., LaCrosse, Wis., U. S. A.

The One and Only Genuine Pyroil (patent protected) Bears this Signature on Every Can.

W. V. Kidder Pres.

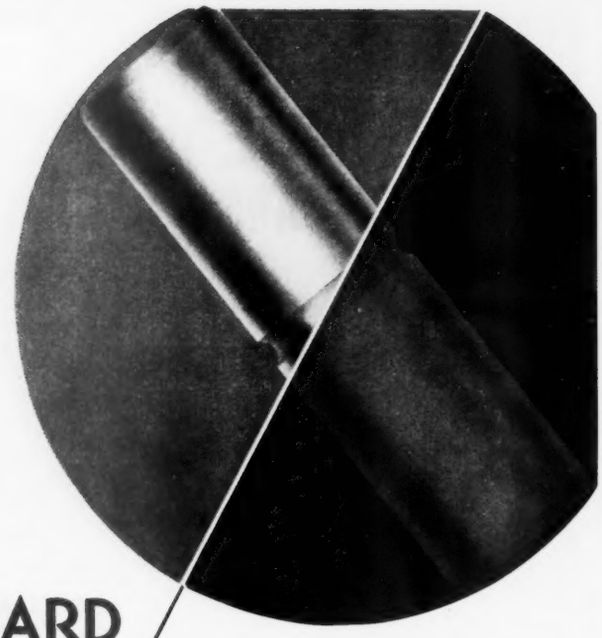
PYROIL COMPANY
873 LaFollette Ave.,
LaCrosse, Wis., U. S. A.

Please send at no obligation, charts, photos, and reports of Pyroil's efficiency with alloy metals—also important business building facts.

Name.....

Address.....

City.....State.....



A SAFEGUARD FOR FRICTION PARTS - -

The gruelling conditions under which the present day automotive engine must function make extra protection imperative. "Dag"* Brand colloidal graphite, when incorporated with a high grade mineral oil, has unquestioned value as a break-in oil. The graphoid surface formed on the friction parts protects against metal-to-metal contact in cases of momentary oil film rupture and aids in a quick return to full film lubrication should a break occur. The extreme chemical inertness of Acheson colloidal graphite insures positive performance with alloy bearings. Further proof of the value and popularity of this material is its increasing use as a constituent of upper cylinder lubricants as well as spring spray oils. Bulletins 92, 112 and 40 will be gladly forwarded gratis to interested inquirers.

*Reg. U. S. Pat Off

dag COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION
FOUNDED [1908] AS ACHESON OILDAG COMPANY
PORT HURON • MICHIGAN

LUBRICATING OIL SALESMAN'S PRIMER

The "Lubricating Oil Salesman's Primer" is a book by Claude Ettele, who is associated with one of the big oil companies in this country. The author's purpose is "to properly present a first view of the subject of lubrication and encourage the young salesman to study advanced works without which he will be unable to develop maximum efficiency in the services of his employers and of his customers."

The book takes up the manufacture of various lubricating oils and greases; tests by which oil and grease specifications are written; general discussion of lubrication problems in cylinders, turbines, internal combustion engines; power transmission machinery such as shafting; wire ropes; belts, gears, bearings, etc., driven machines such as air compressors, pneumatic tools, ice machinery, machine tools, textile machinery, paper mills, mine and quarry machinery.

"Lubricating Oil Salesman's Primer" also gives a standard line of lubricants, and specifies which oils or greases are applicable to the various kinds of machinery. This book is well worth its price of $3.

Send check for your copy today!

NATIONAL PETROLEUM NEWS, 1213 W. 3rd St., Cleveland, Ohio

New Patents

Prepared by R. E. Burnham, patent and trade-mark attorney, 511 Eleventh street, N. W., Washington, D. C., from whom copies may be obtained at the rate of 25c each. State number of patent and name of inventor when ordering.

October 29, 1935

MISCELLANEOUS

Motor fuel—Le Roy G. Story, Glenham, N. Y., assignor to Texas Co. Filed Dec. 8, 1933. No. 2,018,979.

Strainer for gasoline-delivery nozzles—William R. Rice and Hancel M. Lyon, Atlanta, Ga. Filed Aug. 20, 1934. No. 2,019,094.

November 5, 1935

REFINING

Method for treating mineral oil distillates—Adrianus J. van Peski, Bussum, Netherlands, assignor to Shell Development Co. Filed Oct. 7, 1932. No. 2,019,772.

Manufacture of low pour lubricating oil—Merrill Kiser, Lawrenceville, Ill., assignor to Indian Refining Co. Filed May 16, 1932. No. 2,020,066.

Treating hydrocarbon oils—William M. Stratford, New York, N. Y., assignor to Texas Co. Filed Nov. 15, 1930. No. 2,020,086.

Treatment of petroleum hydrocarbons—Thomas T. Gray, Elizabeth, N. J., assignor to Gray Processes Corp. Filed Feb. 23, 1926. No. 2,020,115.

Apparatus employed in treatment of hydrocarbon oils—Howard Dimmig, New York, N. Y., assignor to Gasoline Products Co. Filed Apr. 19, 1934. No. 2,020,241.

MISCELLANEOUS

Process for manufacture of tertiary alcohols—Richard Z. Moravec and William Engs, Berkeley, Calif., assignors to Shell Development Co. Filed Feb. 20, 1933. No. 2,019,762.

Liquid-dispensing device—Clement P. Griffith, Fort Wayne, Ind., assignor to S. F. Bowser & Co. Filed Sept. 30, 1931. No. 2,019,812.

Motor fuels containing inhibitors—Herbert G. M. Fischer, Westfield, and Clifford E. Gustafson, Elizabeth, N. J., assignors to Gasoline Antioxidant Co. Filed June 10, 1933. No. 2,019,899.

Apparatus for testing lubricants—Gerrit D. Boerlage, Delft, Netherlands, assignor to Shell Development Co. Filed May 2, 1934. No. 2,019,948.

Liquid-dispensing system—Charles D. Fagan, Sharon, Pa., assignor to Sharpsville Boiler Works Co., Sharpsville, Pa. Filed Dec. 13, 1932. No. 2,020,112.

Liquid-dispensing apparatus—Joseph C. Woodward, Haverford, Pa., assignor to John Wood Mfg. Co., Conshocken, Pa. Filed Apr. 3, 1935. No. 2,020,272.

"Moonshine" Gasoline Still

NEW YORK, Nov. 16.—While hunting for "mooshine" stills in eastern Washington county, Ohio, recently, internal revenue officers discovered a still which had been converted to the manufacture of gasoline, according to reports received by the American Petroleum Industries Committee.

After their investigation disclosed that the still was being used to manufacture gasoline, the officers destroyed it and cited the alleged owners on charges of evading federal taxes. The federal gasoline tax of 1-cent a gallon applies at the refinery on all gasoline produced.

Oil Trademarks For Copyright

THE following are trademark applications pertinent to our field pending in the United States Patent office which have been passed for publication and are in line for early registration unless opposition is filed promptly. For further information address National Trade-Mark Company, Munsey Building, Washington, D. C., trademark specialists.

As an additional service feature to its readers, this journal gladly offers to them an advance search free of charge on any mark they may contemplate adopting or registering. You may communicate with the Editor of this Department, or send your inquiry direct to the National Trade-Mark Company, stating that you are a reader of this journal.

STA-WAX, Ser. No. 367,859. Lee Goodman, doing business as Sta-Wax Products Co., Mangum, Okla. Filed July 31, 1935.

The word "Wax" is disclaimed apart from the mark.

For Automobile and Furniture Polish.

PERMA-LUSTRE, Ser. No. 361,766, Permatex Company, Inc., Brooklyn, N. Y. Filed Feb. 23, 1935.

The word "Lustre" is disclaimed apart from the mark.

For Polishes and Cleaners for Automobiles, Pianos, Phonographs, Furniture, Floors and Woodwork.

ESSO, in red, enclosed in a blue circle, Ser. No. 368,992. Standard Oil Company of New Jersey, Wilmington, Del. Filed Sept. 4, 1935.

For Refined, Semirefined, and Unrefined Oils Made from Petroleum, Both With and Without Admixture of Animal, Vegetable, or Mineral Oils, for Illuminating, Burning, Power, Fuel, and Lubricating Purposes, and Lubricating Greases.

AMERICAN PRIDE, Ser. No. 369,320. American Pride Oil Co., Chicago, Ill. Filed Sept. 16, 1935.

For Lubricating Oils and Greases.

AMOCO, Ser. No. 369,471. The American Oil Company, Baltimore, Md. Filed Sept. 19, 1935.

For Gasoline, Motor Fuel, Oils, and Lubricating Oils.

ESSO, Ser. No. 368,991. Standard Oil Company, of New Jersey, Wilmington, Del. Filed Sept. 4, 1935.

For Refined, Semirefined, and Unrefiled Oils Made from Petroleum, Both With and Without Admixture of Animal, Vegetable, or Mineral Oils, for Illuminating, Burning, Power, Fuel, and Lubricating Purposes, and Lubricating Greases.

Extends Use of Bottle

NEW YORK—The Socony-Vacuum Oil Co. has now extended the use of its non refillable motor oil bottle to more than 60 per cent of its stations throughout the country.

The bottle was first introduced in New York and New England and later extended to the middle west and Pacific Coast territories of White Star Refining, Wadhams Oil Co., Lubrite Refining, White Eagle Refining and the General Petroleum Corp., all Socony subsidiaries.

FREEDOM *Solvent Processed* OILS *Now Ready*

The Perfect Combination: 100% Pure Pennsylvania Crude, refined by the FREEDOM *Improved* Solvent Process, gives you these 4 sales-making features:

1. **Less variation in viscosity with temperature changes.**
2. **Less carbon deposits.**
3. **Less sludge.**
4. **More efficient lubrication.**

All **FREEDOM** *solvent processed oils are now available in 10-W and 20-W grades . . .*

We are equipped to pack Freedom Solvent Processed Oils in any grade in jobbers' own private-brand cans. Write for prices and specifications.

• • • •

Be among the first to distribute these oils in your territory. Motorists everywhere will be asking for these new solvent processed oils. Act now! Use the coupon.

FREEDOM
THE FREEDOM OIL WORKS CO.
121 THIRD STREET - FREEDOM, PA.

THE FREEDOM OIL WORKS CO.
121 Third Street, Freedom, Pa.

Gentlemen: Send me particulars about the new Freedom Solvent Processed Oils.

NAME .....

ADDRESS .....

CITY .....

Letters to the Editor

Service Station Design

Dear Editor:

I have just had the pleasure of seeing the November 13 issue of NATIONAL PETROLEUM NEWS in which you published the new National Refining Co. station at 25th and Meridian Streets, Indianapolis.

We would have enjoyed it much more if some human interest had been written into it as to how such a functional building was arrived at and why the president of one of the leading pump companies called it the ultimate as a merchandising unit for selling gasoline, oils, etc.

The architecture of a filling station has the right to assert itself as a strictly commercial advertising and sales unit instead of trying to be something else — for instance, as I look out my window, I see the Scottish Rite Cathedral and next to it a filling station that tried to be a miniature of that building and in many of our finer home neighborhoods, stations that look like homes or anything but what they are.

I believe the traveling public is just as design conscious of the filling stations as they are of the automobile and that there are going to be great changes in the designing of service stations.

The greatest handicap to advances in this type of architecture is the attitude of the major companies toward the architect.

In the story you bring to the attention of your readers that there was a 300% business increase. That increase is not only a fact, but it is due to certain things that were done, not generally but specifically done. The problem of the motorist was analyzed and a solution was supplied that would make the business increase a natural result.

I further believe that this station will increase in popularity as it grows older because our friends tell us they get a real thrill in driving up to this station. The business of architecture as an advertising medium is not even remotely known to the major oil companies. I believe that in the next few years there will be fewer stations than there are today but they will be properly planned to accomplish a much more profitable business per unit.

The day of the ugly filling station, the poorly planned filling station, the indifferent filling station, is gone and from a civic standpoint filling stations can add much to the beauty of a city and if you will look at it in the right light, as units of service that are really built for the comfort of the citizens at large rather than for the oil companies and the more they become serviceable to the public, the more they will become profitable to the oil companies.

In publishing the photographs of this station, it should have been mentioned that a design patent has been applied for the protection of the company and the designer.

This letter is written to you in the hope that something might come of it that would elevate the standards of filling station architecture in America.

E. D. Pierre,
Pierre and Wright—Architects,
Indianapolis.

To Install New Furnaces

McPHERSON, Kan., Nov. 18. — Repairs and installation of a new furnace has been started at the Dickey Oil and Refining Co. plant here, and the refinery was expected to be shut down for about two weeks.

Webster Engineering Co., Tulsa, has the contract for the work, and the regular refining crew will do the work. Costs were expected to be approximately $35,000.

PERFORMANCE

—that's Cushing's new gasoline!

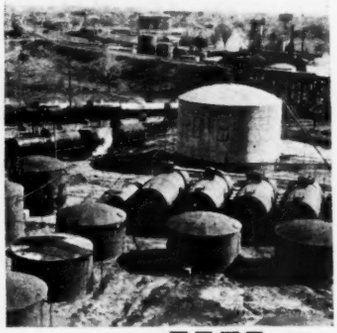
Quality—*a Thoroughbred*

Not another gasoline backed by claims—Cushing's new gasoline is the motor fuel sensation of 1935—high octane, anti-knock and *we guarantee its performance.* Quality that is refined in due to the advanced refining methods of the new Cushing plant, built at a cost of thousands of dollars to bring you this super motor fuel that you can offer YOUR customers without doubt or fear. Cash in on Cushing *Thoroughbred* quality and *Cannonball Service.*

Cannonball Service

WIRE, WRITE OR PHONE FOR QUOTATIONS

Anti-Knock 400 End Point
60-62 Better than U. S. Motor
60-62 Under 400 End Point
64-66 Under 375 End Point
68-70 Under 360 End Point
42-44 W. W. D. T. Kerosene
38-40 Light Straw Zero Distillate
32-36 Overhead uncracked Gas Oil
Cracked Fuel Oil



Partial view of small storage tank section of the new Cushing plant, loading racks and crude plant in the background.

Cushing

REFINING & GASOLINE COMPANY

General Sales Offices: CUSHING, OKLA.
Division Sales Offices: 2007 Foshay Tower
Minneapolis, Minn.

REFINERIES: CUSHING and BLACKWELL, OKLAHOMA

Kentucky Oil Committee Meets

LOUISVILLE, Nov. 19.—The newly appointed general committee of the Kentucky Petroleum Industries Committee held its first meeting at the Brown Hotel here Nov. 12, to consider plans for the year. W. F. Gardner, chairman, presided. Details for organizing county petroleum industries committees were explained by Herbert L. Clay, secretary of the Kentucky Petroleum Marketers Association, and these were approved.

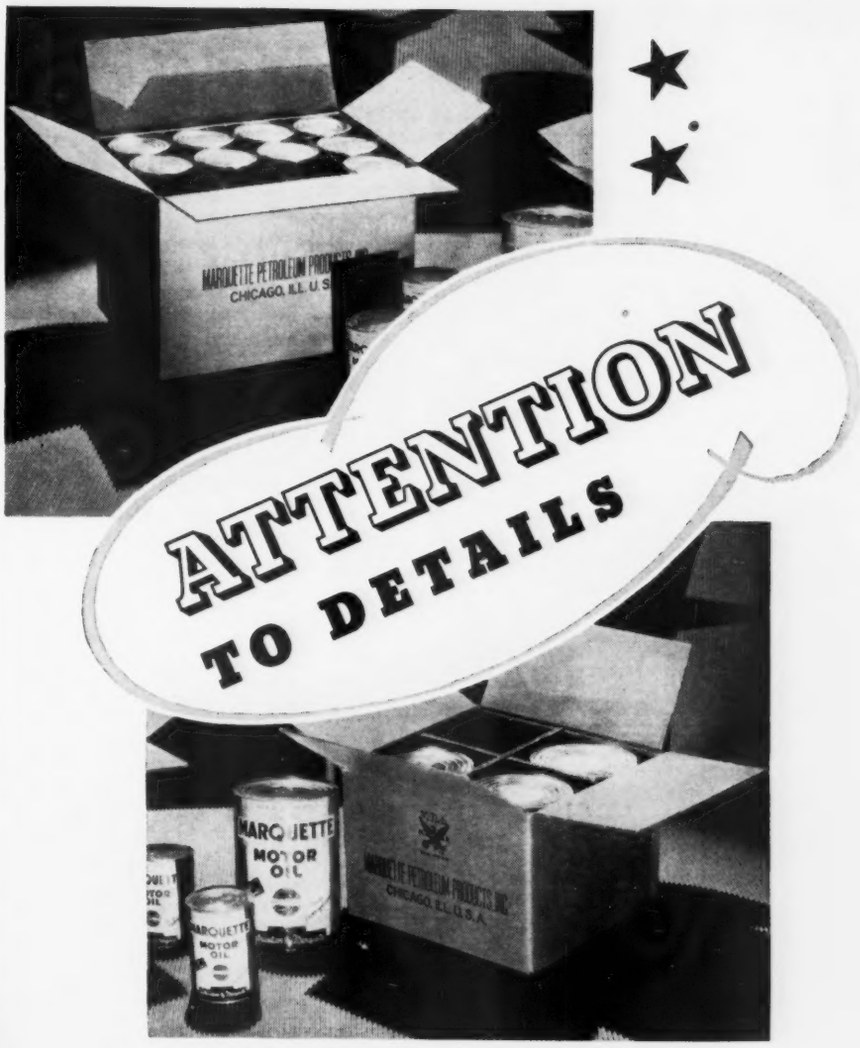
Organization meetings will be held during November at the county seats of Oldham, Shelby, Spencer, Bullitt and Hardin counties.

Another speaker at this meetting was George T. Holmes, secretary of the Kentucky Tax Reduction Association, who outlined the activities of his organization.

New Shell Distributors

LOUISVILLE, Nov. 19.—J. C. Maggard, of Paintsville, Ky., has organized the Big Sandy Petroleum Co., and Bruce Walker has formed the Mountain Oil Co., Lothair, to distribute shell products, F. E. Anderson, Kentucky representative for Shell Petroleum Corp., says, according to the Kentucky Petroleum Marketer, official bulletin of the Kentucky Petroleum Marketers Association.

Irving C. Suellau, who was recently appointed vice-president of the Suburban Fuel Oil Service, Inc., Mount Vernon, New York. Mr. Suellau has been with Suburban since 1929, starting as sales representative. He was made sales manager in 1931 and assistant vice-president of the company in 1934. Prior to his connection with Suburban, Mr. Suellau was with Sinclair Refining Co. and the Sylvestre Oil Co.

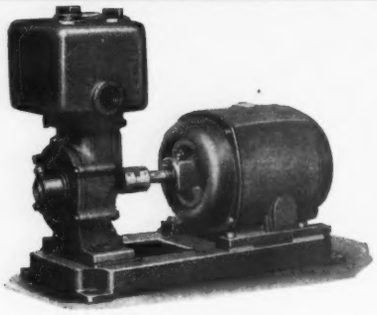


Attention to details in engineering, designing, manufacturing and printing – these are the things that distinguish Hinde & Dauch corrugated fibre shipping boxes from the general run. Much of H & D's reputation has been won by giving attention to the smaller items of shipping box construction. If you see the point, next time order Hinde & Dauch boxes and you'll quickly discover just what we mean by "attention to details." « « «

Send FOR YOUR COPY NOW !

THE HINDE & DAUCH PAPER CO.
218 Decatur Street, Sandusky, Ohio
Send me your book "Modern Box Design"
Name _____
Company _____
Address _____
City _____ State _____

HIGH VACUUM SELF PRIMING Pumps for Bulk Stations that WILL NOT VAPOR LOCK



In selecting a pump for the handling of volatiles two major considerations demand attention.

First —will the pump be able to operate successfully without becoming vapor locked?

Second—to what extent will the pump waste the volatile by causing excessive vaporization?

On both of these points the "R-C" Bulk Station Pump quickly demonstrates its right to a place in your plant. Inherent high vacuum enables the pump to handle an unusually large percentage of vapor in the liquid stream. The smooth, shockless operation of its one moving part—a balanced impeller—keeps vaporization to a minimum.

Ask for Bulletin 260-B12

"Tomorrow's Engineering Approved by Yesterday's Experience."

Roots CONNERSVILLE BLOWER CORP.
CONNERSVILLE, INDIANA
NEW YORK • CHICAGO • POTTSTOWN, PA. • SAN FRANCISCO
PITTSBURGH • BOSTON • DETROIT • ST. LOUIS • LOS ANGELES

Safety Can Ruling Brings Protest From Kerosine Peddlers

NEW YORK, Nov. 14

THE elimination or a large curtailment in numbers of the so-called kerosine peddler from the metropolitan New York market picture is predicted by some oil men if the New York fire department stands by its recent decision to rigidly enforce a city ordinance which requires the use of a safety type kerosine can.

Despite New York's size, there still are many people, mostly in the tenement districts, who use kerosine for light and cooking and in some cases for heating. A goodly portion of this household kerosine business, is now done by the peddlers, who make deliveries in two and five gallon lots.

The peddler goes into business mostly on a small scale; an old stake truck of some sort and a supply of two and five gallon cans being his stock in trade. These cans are similar to the familiar 5-gallon alcohol can and probably cost anywhere from 10 to 30 cents apiece, depending on the size. Every morning the peddler takes his empty cans to some oil company bulk plant and has them filled with kerosine. He sells the kerosine to a customer and loans him the can to store it in. Thus anything which affects the price of the cans hurts the peddler more than the householder.

Under the fire department's ruling, the only way that small quantities of kerosine can be kept in storage is in a safety type can. The cans must be approved by the department before they can be used for oil storage. To date, only four or five manufacturers have had a can approved. At present the cost of the cans range from around $2.25 to $3.50 each, depending on the size.

Estimates are that the smaller peddlers usually have a stock of around 200 cans in operation, half being loaned out to the householder. Suppliers of these peddlers say that most of them are financially unable to purchase a stock of the new safety cans and if the ordinance is strictly enforced it will force these peddlers from the business, or at the least the smaller ones.

Although enforcement of the ordinance was supposed to start on November 1, several oil companies said they were unable to get any definite information from the fire department regarding the regulations and so far as they could tell most of the peddlers were continuing their deliveries in the old type cans.

Representatives of the peddlers and some of the local merchant's associations have protested to the department that the price of the new cans is excessive and will force the householder to discontinue using kerosine if the can price is not lowered or the old type cans used.

Nebraska Organizations Have New Offices

LINCOLN, Neb.—Office of Nebraska Petroleum Marketers, Inc., has been moved from the Terminal Bldg. to 503 Richards Block, in Lincoln.

The Nebraska Petroleum Industries Committee office also has been moved to the same address. The telephone number is B-1829.

The Nebraska Marketers is now engaged in organizing the Industries Committee as public relations committee to inform the consuming public on the burdens of taxation placed on the industry.

Program of the Industries Committee will be explained in detail at the jobbers convention Dec. 3 to 5 in Omaha.

O. D. Corey, Corey Fuel & Oil Co., Lincoln, is president of the Nebraska Marketers. H. H. Hahn, is secretary of the Industries Committee.

Pure Oil Co. Issues Guide For Hunters

MINNEAPOLIS—Pure Oil Co. this fall issued a hunting guide for Minnesota, available to sportsmen at Pure Oil stations, in merchandising its products.

The guide contains a synopsis of official game laws on pheasants, prairie chickens, quail and water fowl. Information pertains to possession, bag, and season limits.

This information is published on the inside spread of the folder, along with the sunset and sunrise schedule. County maps of the state are on this spread to indicate where hunting is permitted.

On the outside of the folder there are two panels, in addition to the title page. One of these panels contains a message urging hunters to be good sportsmen. The other panel advises hunters that the Pure Oil man in the territory can supply local information on accommodations and where to hunt.

Iowa Public Relations Committee Organized

DES MOINES—The Iowa Petroleum Public Relations Committee is being formed and group organization meetings are being held throughout the state.

The organization will consist of state, district and county officials. H. E. Wormhoudt, MonaMotor Oil Co., Council Bluffs, is committee chairman, and M. L. Long, Des Moines, secretary.

The state executive committee will have six members. The nine districts are patterned after the state's nine congressional districts. Each district to have a chairman and a vice-chairman.

Under the districts there will be the county organizations, each county having a chairman and a committee.

The public relations committee will work on legislative matters, and acquaint the motorist in the state with problems affecting the consumer.

Mr. Long has conducted meetings already covering about half the counties in the state. The meeting for the sixth district will be held in Des Moines Nov. 22.

Frank E. Packard, Chicago, chairman of the central division of the American Petroleum Industries Committee, and members of the central division executive committee, will be guests at a dinner prior to this meeting. The dinner will be given by the Iowa executive committee and the chairman and vice-chairman of the sixth division at the Savery hotel.

Nomination Ballots Sent To Nebraska Jobbers

LINCOLN, Neb.—Nebraska Petroleum Marketers, Inc., has sent to members a nomination blank for officers to be elected at the association's annual business meeting during the convention in Omaha Dec. 3 to 5.

Officers to be elected for the year beginning Jan. 1, 1936, are a president, first and a second vice-president. Two directors are to be elected for a three-year term.

Members are to make nominations on the ballot and return it to the association's office. During the business meeting nominations will be called for from the floor.

Organize Against High Tax

NEW YORK, Nov. 16.—Oil men in New York and West Virginia are organizing county committees to protest against high taxes paid by gasoline consumers. The New York county groups, which now number 24, sponsored by the New York Petroleum Industries Committee, have filed protests with legislative representatives against the last increase in the state's gasoline tax levy and the legislature's action in diverting the larger part of the revenues to general state expenses. The committees also are opposing unreasonable restrictions on the operation of motor vehicles.

In West Virginia, nearly 600 oil men have become members of county committees in the 24 counties which have been organized so far.

Dave Gray Resigns

WICHITA FALLS, Nov. 16.—Dave Gray, who has been manager of sales for the Waggoner Refining Co., Electra, for a number of years, has resigned to enter the ranks of independent oil operators in the North Texas area.

Before joining the Waggoner interests Mr. Gray was for a number of years with the Dale Oil & Refining Co.

R. G. Cocoanower of Wichita Falls, who has been sales manager for the Olney Oil & Refining Co. for a number of years, has succeeded Mr. Gray at the Waggoner refinery.

FREE AIR

As long as you have to give it away — cut air costs the QUINCY WAY

MORE ECONOMICAL OPERATION — Quincy Compressors deliver more air for a given amount of power consumed due to their lighter reciprocating parts, reduced friction loss, cooler discharge air and perfect balance.

TROUBLE-FREE OPERATION is assured by failure-proof oiling, positive unloading for motor and belt protection, non-breakable steel valves, ample capacity V-belt drives and heavy duty Timken Roller Bearings.

Added to these are a list of other features which contribute to Quincys' third money saving advantage — **A LONGER SERVICE LIFE.**

Get the Facts

Fill in and mail coupon below for complete data on Quincy Compressors. QUINCY COMPRESSOR CO., QUINCY, ILL.

QUINCY Compressors

MAIL COUPON TODAY

Quincy Compressor Co., Quincy, Ill. Dept. N-11
Send me complete data on Quincy Compressors.

Name..... Street.....

City..... State.....

Transactions in Oil Stocks on New York Stock Exchange

1934 High	1934 Low	1935 High	1935 Low	Listed Shares	Par Value	Company	Current Dividend	Last Div. Paid	Transactions Week Ended Nov. 16 Sales Shares	High	Low	Last	Week's Change
55⅝	39	77¾	48½	788,675	N.P.	Amerada Corp.	50cQ	Oct. 31, 35	5,900	76¾	74½	74½	— 1
40½	29½	40½	29¾	2,290,412	$25	Associated Oil Co.	45c	June 25, 35	40	38¼	38	38	— ½
35¼	21½	28	20½	2,696,652	25	Atlantic Refining Co.	25cQ	Sept. 16, 35	19,800	25½	23½	24⅞	+ 1⅛
10	5⅞	12½	5⅞	2,258,779	5	Barnsdall Corp.	20c	Nov. 1, 35	48,400	*12½	11¼	12½	+ ⅞
9¾	5	9¾	6¾	1,444,970	N.P.	Colonial Beacon Oil Co.	....	.....	.....	....	....	....	.....
14¼	7¼	10½	6½	13,996,072	N.P.	Consolidated Oil Corp.	25c	Oct. 10, 35	54,600	9⅜	9	9⅜	+ ⅛
112½	108	112½	109	132,771	$100	do pfd.	$2Q	Nov. 15, 35	500	110½	110⅛	110⅜	— ¼
22¾	15¾	28¼	15⅛	4,722,652	5	Continental Oil Co.	25c	Oct. 31, 35	53,700	*28¼	25	28¼	+ 3
23½	12	21	11¾	413,333	$10	General Asphalt Co.	....	.....	17,000	*21	19	20⅞	+ 1¼
29¾	12½	17¾	9½	95,841	100	Houston Oil Co.	....	.....	.....	....	....	....	.....
5⅝	2½	4⅝	1½	678,234	25	do v.t.c.	....	.....	18,700	4⅜	4	4⅜	+ ⅜
4⅜	2⅜	3¼	2⅛	1,207,132	10	Indian Refining Co.	....	.....	700	*3¼	2¾	3⅛	+ ⅜
3⅜	⅝	1⅞	⅝	1,309,060	N.P.	Louisiana Oil Ref'g. Corp.	....	.....	1,000	⅞	⅝	⅞	— 1/8
23½	7¼	14½	4½	40,000	$100	do pfd.	....	.....	40	9½	9½	9½	0
3¼	1⅛	3	1	330,000	N.P.	Maracaibo Oil Exploration Co.	....	.....	2,400	2¼	2	2¼	0
14⅝	9½	16⅞	9½	1,857,912	$10	Mid-Continent Pet. Corp.	15c	June 1, 35	31,300	16⅝	15½	16⅝	+ 1⅛
15⅞	8½	14⅜	9¼	6,563,377	N.P.	Ohio Oil Co.	15c	June 15, 35	21,900	12	11⅜	11¾	+ ¼
11½	10¼	12	10¼	4,699,885	$5	Pan Amer. Pet. & Transp. Co.	....	.....	100	11¼	11¼	11¼	— ½
2½	⅝	1½	½	199,370	N.P.	Panhandle Prod. & Ref'g. Co.	....	.....	800	1¼	1⅛	1¼	0
21½	7	19½	6½	17,994	$100	do pfd.	....	.....	20	17	17	17	— 1
14¼	8¼	11⅝	7¾	2,153,444	5	Petroleum Corp. of America	33c	Oct. 31, 35	7,500	11⅝	10⅝	11⅜	+ ⅜
20⅜	13⅜	37⅝	13¾	4,439,450	N.P.	Phillips Petroleum Co.	25cQ	Aug. 30, 35	55,600	36⅞	34⅝	36½	+ ¾
1⅜	⅝	⅝	¼	1,184,817	$25	Pierce Oil Corp.	....	.....	3,500	½	⅜	½	0
10¾	4½	6⅛	2¾	150,000	100	do pfd.	....	.....	900	4⅞	4¼	4¼	— ⅛
2	¾	1⅜	⅝	2,500,000	N.P.	Pierce Petroleum Corp.	....	.....	1,300	1	⅞	1	+ ⅛
16¾	7¼	12¼	6½	1,050,000	$5	Plymouth Oil.	25cQ	Mar. 30, 35	13,100	12¼	11⅝	12	+ ½
14⅞	6½	12¼	5⅞	3,038,370	N.P.	Pure Oil Co.	....	.....	38,200	12¼	11¼	12	0
63	33½	99½	34¾	167,640	100	do 6% pfd.	....	.....	1,000	98	95	97	+ 1
80	49	113½	49¾	130,000	$100	do 8% pfd.	....	.....	790	*113¼	109¾	113	+ 4¾
39⅛	28⅝	47¼	29½	425,342	a	Royal Dutch Co. (N. Y. shares)	$1.70	Aug. 1, 35	400	*47¼	46¾	47¼	+ 1½
38⅝	20¾	35⅞	20¾	1,244,383	N.P.	Seaboard Oil of Del.	25cQ	Sept. 15, 35	7,100	33⅝	31½	32½	+ 1
26½	19	38¼	20⅝	56,148	£2	Shell Transport & Trading Co.	$1.237	July 24, 35	50	*38¼	38⅛	38⅛	+ ⅝
11⅜	6	14⅛	5½	13,070,625	N.P.	Shell Union Oil Corp.	....	.....	58,700	*14⅛	11⅞	13⅞	+ 1⅞
89	57	111	63¼	400,000	$100	do pfd w.w.	....	.....	5,300	*111	107¼	108½	+ 2½
17⅛	7¼	18¾	4½	461,000	10	Simms Petroleum Co.	**$1.25	Oct. 18, 35	8,900	5⅛	4⅞	5	0
11⅜	6	17	6⅜	1,100,069	25	Skelly Oil Co.	....	.....	4,300	16⅝	15	16⅛	+ 1⅛
68½	51⅜	106	60	120,000	100	do pfd.	....	.....	300	104	103¼	104	0
19⅞	12½	15¾	10⅛	31,701,348	15	Socony Vacuum Oil Co.	15c	Sept. 16, 35	73,400	12⅝	11¾	12⅜	+ ⅛
114	96½	116	111	764,925	100	S. O. Export Corp. pfd.	$2.50S.A.	June 29, 35	500	112½	112½	112½	+ ⅜
42⅞	26½	38⅞	27¾	13,102,900	N.P.	S. O. California.	25cQ	Sept. 16, 35	18,900	38⅝	37	38⅜	+ 1¼
32¾	23¼	28¾	23	15,215,677	$25	S. O. Indiana.	25c	Sept. 16, 35	28,900	*28¾	27⅞	28⅝	+ ¾
41	26	32	20	146,542	10	S. O. Kansas.	50c	Oct. 31, 34	500	27	24	27	+ 4
50⅛	39¼	50⅛	35¾	25,740,965	25	S. O. New Jersey.	50c a.a.	June 15, 35	61,500	50⅜	48⅝	49⅞	+ 1¼
74¼	51⅜	75½	60½	1,590,406	N.P.	Sun Oil Co.	25cQ	Sept. 16, 35	2,200	75¼	73	75¼	+ 2¼
118	100	121	115½	100,000	$100	do pfd.	$1.50Q	Sept. 3, 35	80	120¼	120	120¼	+ 1¼
3	1¼	3	1⅛	966,979	$1	Superior Oil Corp. (Del.)	....	.....	10,700	2¾	2¾	2⅝	+ ⅛
29⅜	19⅜	25⅜	16½	9,851,236	$25	The Texas Corp.	25cQ	Oct. 1, 35	90,100	*25⅛	22⅝	25⅛	+ 2⅜
6¼	2⅝	9¼	3¼	930,570	10	Texas Pacific Coal & Oil Co.	....	.....	6,400	8⅞	8¼	8¼	— ⅛
14⅝	8	12	7⅝	5,998,919	N.P.	Tide Water Associated Oil Co.	....	.....	31,700	12	11⅜	12	+ ⅝
87	64½	104½	84	695,503	$100	do pfd C. T. V.	$1.50	Oct. 1, 35	2,300	*104⅛	102	104⅛	+ 2⅜
40	24	43⅜	26¾	2,191,823	N.P.	Tide Water Oil Co.	50c	Sept. 30, 35	.....	....	....	....	.....
20⅛	11⅛	21	14¾	4,386,070	25	Union Oil of California.	25cQ	Nov. 9, 35	12,800	*21	20¼	20⅞	+ ⅝
25½	15⅝	26⅛	20¼	1,200,000	N.P.	Union Tank Car Co.	30cQ	Sept. 3, 35	3,700	24¼	23¾	24	+ ⅛
3⅛	1	1⅝	⅝	759,538	N.P.	Warner Quinlan Co.	....	.....	6,500	1¼	¾	1⅛	+ ⅜
5¾	2	2⅝	1	431,443	$5	H. F. Wilcox Oil & Gas Co.	....	.....	800	2⅛	2	2⅛	+ ⅛

*New high. †New low. x Ex-div. **Dividends of liquidation. ‡Stock dividend. a Par 33 1/3 florins.

Standard Oil Stocks on New York Curb Market

1934 High	1934 Low	1935 High	1935 Low	Shares Issued	Par Value	Company	Current Dividend	Last Div. Paid	Transactions Week Ended Nov. 16 Sales Shares	High	Low	Last	Week's Change
11	6	11¼	6	36,000	$25	Borne Scrymser Co.	50c	Oct. 15, 35	250	9¾	9	9¾	+ ¼
38	26	42½	30½	200,000	50	Buckeye Pipe Line Co.	75cQ	Sept. 14, 35	450	*42½	41½	42½	+ 1½
150	116	157	115	120,000	25	Chesebrough Mfg. Co.	$1.50	Sept. 27, 35	200	126	125	125	0
14⅝	9⅝	23½	10	5,977,873	N.P.	Creole Petroleum Co.	....	.....	11,100	22⅜	21¼	22¼	+ ⅛
37	30	38	33¼	50,000	$50	Eureka Pipe Line Co.	$1Q	Nov. 1, 35	50	36	36	36	0
49¼	33¼	64	44	8,968,479	N.P.	Humble Oil & Refg. Co.	25cQ	Oct. 1, 35	5,800	62	60	60¼	— 1
17⅞	12⅝	22⅛	15⅜	26,919,871	N.P.	Imperial Oil Ltd.	‡25cS.	June 1, 35	12,800	22⅛	20¾	20⅞	— 1
17⅛	12½	22⅝	16½		N.P.	do registered.	25cQ	June 1, 34	500	21⅝	21	21⅝	— ½
6¼	3¾	5¼	3⅝	300,000	$10	Indiana Pipe Line Co.	20c **	Nov. 15, 35	700	5⅜	5⅛	5⅛	+ ¼
33⅜	19⅜	39⅛	28	14,324,088	N.P.	International Pet. Co.	‡75cS.	June 1, 35	29,600	38⅞	35¼	37½	— ½
9½	7	10½	6¾	509,000	$12.50	National Transit Co.	35c	Dec. 15, 34	1,000	9½	9¼	9¼	0
4¾	3	4¾	3	100,000	5	New York Transit Co.	15c S.A.	Oct. 15, 34	100	4¼	4¼	4¼	— ¼
7	4¼	8	5¼	120,000	10	Northern Pipe Line Co.	25c S.A.	July 1, 35	300	7¼	7¼	7¼	— ⅛
91	83½	107¼	90¼	562,122	100	Ohio Oil Co. pfd.	$1.50Q	Sept. 14, 35	600	103⅞	103½	103¾	— ⅛
8⅛	3¾	11	5¼	400,000	25	Penn Mex. Fuel Co.	....	Dec. 22, 33	200	7½	7	7½	+ ⅛
5½	3¼	5	3¼	100,000	10	Southern Pipe Line Co.	15c	Sept. 3, 35	100	4¾	4¾	4¾	+ ¼
26½	17½	29	21⅝	1,200,000	25	South Penn Oil Co.	30c	Sept. 30, 35	3,100	28	27	28	+ 1
47	41	52⅛	45¼	35,000	50	South West Pa. Pipe Lines.	$1Q	July 1, 35	100	44¼	44¼	44¼	— 1¼
18⅛	14⅝	23¾	18	2,604,790	10	S. O. Kentucky.	25c	Sept. 14, 35	6,900	*23¾	21⅝	23½	+ 1½
16⅝	8¼	12	7¾	188,403	25	S. O. Nebraska.	....	June 20, 34	500	11⅜	11	11	— ½
28⅜	12⅜	23⅜	11⅜	753,740	25	S. O. Ohio.	....	Apr. 16, 34	7,800	23	18⅛	22⅞	+ 2⅝
95	77½	99½	91	120,000	100	do 5% pfd.	$1.25Q	Oct. 10, 35	50	95	95	95	+ ¾
4¼	2⅝	5¼	2¼	34,158	25	Swan Finch Oil Corp.	....	Dec. 1, 30	700	5⅜	3⅞	5⅜	+ 1⅜

*New high. †New low. ‡Imperial Oil Spec. 37½c June 1, 35. International Pet. Spec. 50c June 1, 35.
x Ex dividend.
**15c regular; 5c extra.

Jesse Finston Dies

TULSA, Nov. 14.—Jesse Finston, secretary-treasurer of the Bell Oil & Gas Co., and an oil marketer in Tulsa for the past 20 years, died in his office in the Philtower here Nov. 14 following a heart attack. He was 52 years old.

Mr. Finston was born in Cincinnati, where he spent his early life. He came to Tulsa in 1916 and for a time was in charge of the Mid-Co Refining Co. Later he organized the Altitude Petroleum Co., but this firm was dissolved five years ago when he joined the Bell company which had been organized by his brothers, Albert and the late Mark Finston.

Tax Conference in Memphis

CHICAGO — A meeting of the southeastern group of the North American Gasoline Tax Conference has been called for Dec. 7 in Memphis, at 9 a. m. in the Gayoso hotel, by the regional vice-president, George L. Stockton.

Oil and Royalty Stocks on New York Curb

1934 High	1934 Low	1935 High	1935 Low	Par Value	Company	Transactions Week Ended Nov. 16 Sales Shares	High	Low	Last	Week's Change
1 1/4	1/2	1	5/8	N.P.	American Maracaibo..	1,300	3/4	11/16	3/4	0
2 7/8	1	3	5/8	N.P.	Arkansas Nat. Gas....	1,900	2 3/4	2 1/2	2 5/8	+ 1/4
2 3/4	5/8	2 7/8	5/8	N.P.	do A.....	4,800	2 1/2	2 3/8	2 3/8	— 1/8
3 1/8	1 3/4	7	2 1/4	$10	do pfd.....	6,400	6 3/8	6	6 1/4	0
5 1/8	12 3/4	16 1/4	14 1/2	N.P.	British Amer. Oil coup.	100	15 7/8	15 7/8	15 7/8	+ 1/8
5 1/2	1 1/2	4 1/4	1 5/8	$1/4	Carib Syndicate.....	8,800	3 1/2	2 3/4	3 3/8	+ 5/8
4 1/4	1 1/4	3 1/4	3/4	N.P.	Cities Service.....	98,300	3	2 5/8	3	0
6 7/8	11 1/4	31 1/2	6 1/8	$100	do pfd.....	4,900	30 7/8	29	30 1/2	+ 1
2 1/2	1 1/8	3 3/4	5/8	10	do pfd. B.....	400	*3 3/4	3 1/4	3 1/4	— 1/8
3 1/2	9	30	6	100	do pfd. BB.....	....	....	....	....	....
3 1/4	1/2	2 1/8	5/8	N.P.	Colon Oil Corp.....	4,700	1	7/8	1	0
1 3/4	3/8	1 1/2	3/8	N.P.	Columbia Oil & Gas vtc.	1,800	1	7/8	1	— 1/8
2	1 1/2	3	1	$1	Consolidated Royalty..	700	3	2 5/8	2 5/8	— 3/8
3 1/8	1/2	7/8	1/4	N.P.	Cosden Oil.....	200	1/4	1/4	1/4	— 1/8
9	2 1/2	2	1	$100	do pfd.....	1,600	1	3/4	7/8	— 1/2
1 1/4	3/4	1 1/2	5/8	N.P.	Crown Central Pet.....	2,500	1 3/8	1 1/4	1 3/8	+ 1/8
7 1/2	4 1/8	6 3/4	4	N.P.	Darby Petroleum.....	500	6 1/2	6 1/2	6 1/2	— 1/4
2 1/4	1	2	3/4	N.P.	Derby Oil & Refg.....	400	1 5/8	1 3/8	1 5/8	+ 1/4
....	....	20	20	N.P.	do pfd.....	....	....	....	....	....
76 3/4	50	74 3/4	50 1/4	$25	Gulf Oil Corp.....	10,100	69 1/4	65 1/2	67 3/4	— 1/4
4 1/2	1 1/4	4 1/4	1 3/8	N.P.	Indian Ter. Illg. Oil A	100	2 3/8	2 3/8	2 3/8	— 1/8
4 1/2	1 1/4	4 1/4	1 1/2	N.P.	do B.....	300	2 5/8	2 1/2	2 1/2	— 1/8
3	1 1/8	3	1 1/8	N.P.	Kirby Petroleum.....	1,500	3	2 7/8	2 7/8	+ 1/4
1/8	1/16	3/8	1/16	$25	Leonard Oil Dev.....	300	1/16	1/16	1/16	+ 1/16
6	3 3/8	6 3/4	3 1/8	N.P.	Lion Oil Refg.....	300	6	5 1/2	6	+ 1/2
8 1/4	4 1/4	10 7/8	4 1/2	N.P.	Lone Star Gas.....	6,700	10 7/8	10 1/4	10 5/8	+ 1/8
8 1/4	5 1/4	19	4	N.P.	Margay Oil Co.....	300	18	17	17 3/4	— 1/4
2 1/4	1	2 3/8	7/8	N.P.	Mexico-Ohio Oil.....	100	2 3/8	2 3/8	2 3/8	0
5	2 5/8	3 3/8	1 1/8	N.P.	Michigan Gas & Oil....	100	2 3/4	2 3/4	2 3/4	0
2 7/8	1	3 1/2	7/8	N.P.	Mid. States Pet. A vtc.	9,400	*3 1/2	2 1/4	3 1/4	+ 1
1 1/8	1/4	1/2	1/4	N.P.	do B vtc.....	4,300	*1/2	1/16	1/2	+ 1/4
1/4	1/16	3/8	1/4	$1	Mountain & Gulf.....	....	....	....	....	....
5 1/2	4	5 1/2	4 1/8	10	Mountain Producers...	1,800	5	4 7/8	5	0
18 1/2	1/2	20	13 1/2	N.P.	National Fuel Gas....	5,600	19 1/4	18	18 1/2	— 5/8
2 1/2	1 3/4	3 1/4	2	$5	New Bradford Oil.....	1,100	2 7/8	2 5/8	2 7/8	+ 3/8
3 5/8	1 3/4	3 1/4	2	N.P.	North Central Texas..	....	....	....	....	....
1/16	1/16	1/16	1/16	N.P.	North European.....	100	1/16	1/16	1/16	0
10 5/8	8 1/4	12	9 1/2	N.P.	Oil Stocks Ltd. A.....	....	....	....	....	....
2 5/8	7/8	3 1/16	1 1/4	N.P.	Pantepec of Venezuela.	13,500	3 3/8	3 1/8	3 1/4	— 1/8
5/8	1/4	1/16	1/8	N.P.	Producers Royalty....	3,100	1/16	1/8	1/16	+ 1/16
63	33 1/2	70	34 3/4	$100	Pure Oil 6% pfd.....	....	....	....	....	....
1 1/2	3/4	1 1/2	1/2	N.P.	Red Bank Oil.....	1,100	*1 1/2	5/8	1 1/2	+ 7/8
1	1/16	1/4	1/16	N.P.	Reiter-Foster Oil.....	....	....	....	....	....
4	2 1/2	1 3/8	1/2	$25	Richfield Oil pfd.....	300	3/4	3/4	3/4	0
1 1/4	3/4	4 1/2	1	..	Root Petroleum.....	900	3 1/2	2 7/8	3 1/2	+ 5/8
8 1/4	3 1/2	12	4	10	do conv. pr. pfd...	....	....	....	....	....
....	....	....	....	$10	Royalty Corp. pfd.....	....	....	....	....	....
3 1/8	7/8	1 3/8	5/8	N.P.	Ryan Consolidated....	400	1 1/16	1	1 1/16	0
1	1/16	1	1/16	$10	Salt Creek Consolidated	1,500	11/16	5/8	5/8	— 1/8
7 1/8	5	7 1/2	5 1/2	10	Salt Creek Prod.....	1,200	6 7/8	6 5/8	6 3/4	0
6	4 7/8	6 7/8	4 3/4	N.P.	Southland Royalty....	1,900	6 1/2	6 1/4	6 1/4	0
2	1/4	2 7/8	1/4	$5	Sunray Oil.....	8,400	2 1/2	2 1/4	2 3/8	— 1/8
....	....	3 3/8	2	$1	Swiss Oil Corp.....	1,300	2 5/8	2 1/2	2 1/2	0
11	4 3/4	6 1/8	5	N.P.	Texon Oil & Land.....	1,500	6 1/2	6 1/8	6 3/8	+ 1/4
1 1/2	1/2	3	1/16	$5	Venezuela Petroleum..	12,400	2 1/8	1 3/4	1 7/8	0
5 1/4	2 3/4	6 1/8	3 1/2	1	Woodley Petroleum...	1,400	5 1/2	5 1/8	5 1/2	+ 1/4

†New high. †New low.

New York Bonds

Week Ended Nov. 16

	High	Low	Last	Change
Atlantic Refg. deb. 5s...	106 1/4	106 1/4	106 1/4	— 1/4
Houston Oil 5 1/2s '40....	100 3/8	99 3/4	100	0
Pan Amer. Pet. of Calif. 6s	39 1/2	39 1/2	39 1/2	— 1/2
Pan Amer. Pet. of Calif. 6s ctfs.....	40 1/2	40 1/4	40 1/4	+ 5/8
Phillips Pet. 5 1/4s.....	101 1/4	101	101	— 1/8
Pure Oil 4 1/4s.....	105	103 1/4	105	+1 3/8
Richfield Oil of Calif. 6s..	31	30	31	+ 1/8
Richfield Oil of Calif. 6s ctfs.....	31 1/4	30	31 1/4	+1 1/4
Shell Union Oil 5s.....	104	103 3/4	104	+ 1/4
Shell Pipe Line 5s.....	104 1/8	103 3/4	104	+ 1/4
Skelly Oil 5 1/2s.....	102 3/4	102 3/8	102 1/2	0
Socony-Vacuum 3 1/2s....	102 1/2	101 3/4	102 1/2	+ 7/8
Union Oil of Calif. 6s A..	119	119	119	0
Union Oil of Calif. 4s '47.	115 1/2	114	114 1/2	+ 1/2
Warner-Quinlan 6s.....	28 1/8	22	26 5/8	+4 1/8

Royalty Owners Meet

TULSA, Nov. 16.—The Mid-Continent Royalty Owners Association, holding its annual business session here Nov. 12, named 50 directors and four alternates to serve for the ensuing year.

Robert H. Wood, J. L. Goddard, Marvin T. Johnson, George H. Ernest and Arthur Duston, were appointed to name nominations for the new officers to be elected at a meeting next week.

Pittsburgh Stock Exchange

Transactions Week Ended Nov. 15, 1935

	Sales	High	Low	Last	Change Over Week
Ark. Nat. Gas pfd.	1,500	6 1/8	6	6 1/8	0
†Cities Serv.....	824	3 1/4	2 1/2	2 3/4	— 3/8
Col. Gas & Elec...	1,359	15 1/8	13 7/8	14 5/8	— 1/2
Devonian Oil....	50	15 1/2	15 1/2	15 1/2	— 1/2
Lone Star Gas....	5,508	10 3/8	10 1/8	10 3/8	— 1/8
†‡ do 6 p.c. conv. pfd.....	139	101 1/2	100 1/4	101	+ 5/8
Mountain Fuel Supply.....	2,705	5 1/2	5 1/4	5 1/2	0
Plymouth Oil....	94	12 1/8	12	12 1/8	+ 3/4
Shamrock Oil & Gas.....	9,675	2 1/8	2	2	— 1/8
†Standard Oil of N. J.....	1,648	50 1/2	48 5/8	49 5/8	— 1/2

†Unlisted. ‡New high record.

Cleveland Stock Exchange

Transactions Week Ended Nov. 16, 1935

	Sales	High	Low	Last	Change Over Week
Canfield Oil.....	....	....	....	....	....
Nat'l Refining....	310	4 3/4	4 3/4	4 3/4	— 1/4
do pfd.....	12	55	55	55	0

New York Curb Bonds

Week Ending Nov. 16

	High	Low	Last	Change
Cities Serv. 5s '50.....	70 5/8	66 3/4	69 3/4	+2
Cities Serv. 5s '66.....	66	66	66	0
Cities Serv. G. 5 1/2s '42..	95 1/4	94 5/8	94 3/4	0
Empire O & R 5 1/2s '42..	77 1/4	75 1/2	77 1/4	+1 1/8
Gulf Oil 5s '47.....	107	106 1/4	107	+1
Valvoline Oil 7s '37.....	96	96	96	—3

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Disturbed Conditions on West Coast Cut S. O. California Earnings

THE disturbed condition of the west coast markets was reflected in the third quarter statement issued by Standard Oil Co. of California. Earnings in the quarter just ended were $5,175,858, equal to 39 cents a share on 13,102,900 shares of no-par common stock. In the same quarter, 1934, the company reported net profit of $5,915,607, equal to 45 cents a share.

Net income for the September, 1935, quarter, however, was not sufficiently below the same quarter last year to offset the gain shown in the first half of 1935 over the first half of 1934.

Net profit for the first nine months of this year was $15,759,000, equal to $1.20 a share compared with $13,246,441, equal to $1.01 a share the first nine months of 1934.

Consolidated income account of Standard of California for the quarter ended Sept. 30, 1935, compares as follows:

	1935	1934
Operating income	$9,653,835	$10,617,214
Other income	369,312	221,232
Total income	$10,023,147	$10,838,446
Depr., depl., and amortz.	4,507,288	4,362,838
Fed. taxes	335,000	555,000
Pfd. divs. of subs	5,000	5,000
Net income	$5,175,859	$5,915,608
Nine months ended Sept. 30:		
Operating income	$29,136,384	$26,530,863
Other income	826,583	640,703
Total income	$29,962,967	$27,171,566
Depr., depl. and amortz.	13,083,966	12,755,124
Fed. taxes	1,105,000	1,155,000
Pfd. divs. of subs	15,000	15,000
Net income	$15,759,001	$13,246,442

* * *

International Pet. Co.

International Petroleum Co., Ltd., report for the year ended June 30, 1935 shows net profit of $21,666,535 after depreciation, depletion, amortization, income taxes, minority interests and other charges, equal to $1.49 a share on combined 200,000 shares (par $2.50) of preferred and 14,324,088 no-par common shares.

Current assets on June 30, last, amounted to $61,868,350 and current liabilities were $4,425,438. Current assets include $19,791,020 in cash and $18,915,767 in bonds at cost plus accrued interest. Inventories of crude oil and refined products were carried at $2,612,774.

* * *

Houston Oil Co.

A net profit of $218,772, after interest, depreciation, depletion, property retired and abandoned, amortization and federal taxes was reported by Houston Oil Co. of Texas and its wholly owned subsidiary Houston Pipe Line for the quarter ended Sept. 30, 1935. After allowing for quarterly dividend requirements on the preferred stock on which there is an accumulation of unpaid dividends, the profit is equal to seven cents a share on 1,098,618 shares of common.

A net loss of $56,358 was sustained in the September 1934 quarter.

For the nine months ended Sept. 30, last, net profit was $634,522 after charges and taxes, equal, after preferred dividend requirements for the period, to 21 cents a share on the common. In the first nine months of 1934 the profits did not entirely cover requirements on the preferred.

* * *

Colonial Beacon

BOSTON—Colonial Beacon Oil Co. sustained a loss of $2,645,290 after taxes, depreciation, interest, etc. in the nine months ended Sept. 30, 1935. In the same period of 1934 net loss was $1,322,445.

Based on comparison of company's reports for six and nine months, the loss sustained in the September 1935 quarter was $539,310 after taxes and charges. In the September 1934 quarter net loss was $274,867.

* * *

Simms Petroleum Co.

NEW YORK—A report on the progress of the liquidation of Simms Petroleum Co. for the quarter ended Sept. 30, 1935 shows profit of $28,177 after expenses, taxes, and other deductions, but before depreciation and depletion.

For the nine months ended Sept. 30, 1935 profit before depreciation and depletion was $11,996. This includes income and expenses of Simms Petroleum Co. from Jan. 1, 1935 to Sept. 30, 1935 and of Simms Co. from June 1 only.

Litigation involving title to property in Yates oil fields, Pecos county, Texas together with possible obligation to account for past production therefrom, has been settled by payment of $350,000 to the state of Texas and individual claimants. This money was taken out of the escrow fund established under agreement of May 14, last, when stock of Simms Oil Co. was sold to Tide Water Oil Co.

* * *

No Income or Expense

Since neither Skelly Oil Co. nor Tide Water Associated Oil Co. paid a dividend on their common stocks in the first nine months of 1935, Mission Corp. reported no income for the period. It also reported no expense for the period.

Mission's total assets consist mainly of 20 per cent interest in the common stock of Tide Water Associated and 55 per cent interest in the common stock of Skelly.

Mission's equity in the reported nine months earnings of the two companies after deducting an amount equivalent to the preferred dividend requirements of these companies is $1,304,436.

* * *

Wiliams Declares Dividend

BLOOMINGTON, Ill.—Directors of the Williams Oil-O-Matic Heating Corp., Bloomington, Ill., have voted a dividend of 50 cents on capital stock, payable Dec. 2 to stockholders of record Nov. 19.

A financial statement of the company is to be mailed late in November.

Oil Dividends

Declared Last Week

Company	Amount	Record	Payable
Imperial Oil s	25c	Nov. 15	Dec. 2
Imperial Oil special	37½c	Nov. 15	Dec. 2
International Pet. s	75c	Nov. 23	Dec. 2
International Pet. Special	50c	Nov. 23	Dec. 2
Northern Pipe Line s	25c	Dec. 13	Jan. 2

Dividends Waiting Payment

Buckeye Pipeline q	75c	Nov. 22	Dec. 14
Hancock Oil of Calif. "A"	25c	Nov. 14	Dec. 1
Hancock Oil of Calif. "B"	25c	Nov. 14	Dec. 1
McColl-Frontenac q	20c	Nov. 15	Nov. 30
Mid-Continent Pet.**	25c	Nov. 1	Dec. 2
Ohio Oil*	15c	Oct. 31	Dec. 14
Ohio Oil pfd	$1.50	Dec. 2	Dec. 14
Phillips Pet. q	25c	Nov. 1	Nov. 30
Phillips Pet. extra	25c	Nov. 1	Nov. 30
Seaboard Oil of Del. q	15c	Nov. 30	Dec. 14
Seaboard Oil of Del. extra	10c	Nov. 30	Dec. 14
Standard of Calif. q	25c	Nov. 15	Dec. 16
Standard of Indiana q.	25c	Nov. 16	Dec. 16
Standard of N. J. s	50c	Nov. 16	Dec. 16
Standard of N. J. extra	25c	Nov. 16	Dec. 16
Sun Oil q	25c	Nov. 25	Dec. 16
Sun Oil stock	7%	Nov. 25	Dec. 16
Sun Oil pfd. q	$1.50	Nov. 9	Dec. 2
Union Tank Car q	30c	Nov. 15	Dec. 2

*Last paid 15c Sept. 1, '34.
**Paid 15c June 1, '35.

S. O. Indiana Launches New Gasoline Brand

CHICAGO, Nov. 11.—"The Fastest-Starting Gasoline in Standard Oil History Has Arrived," is the headline of the huge advertising campaign launched Nov. 9 in 1565 newspapers in 13 north central states by Standard Oil Co. of Indiana.

The company claims "35% quicker warm-up." The advertisement suggests the use of a light winter motor oil to insure active lubrication of all moving parts, because the new gasoline turns on full power so quickly.

The newspaper campaign will be supplemented by posters, station signs and banners, as well as the company's one-hour radio broadcast every Sunday evening.

Canadian "Gas" Demand Up 8.53% In July

OTTAWA, Nov. 15.—Gasoline consumption in Canada in July totaled 67,159,000 Imperial gallons, as compared with 61,879,000 gallons in July a year ago, an increase of 5,280,000 gallons, or 8.53 per cent, according to the Transportation Branch of the Dominion Bureau of Statistics here.

Increases were indicated in all of the nine provinces, ranging from 4.31 per cent in Saskatchewan to 15.25 per cent in Prince Edward Island.

In the seven months ended July this year, demand totaled 294,822,000 gallons, an increase of 24,950,000 gallons or 9.2 per cent over the corresponding period of 1934.

Detailed figures are given in the table below.

Gasoline Consumption in Canada in July

(In Thousands of Imperial Gallons)

	July 1935	July 1934	% Change 1935 over 1934
Prince Edward Island	423	367	+15.25
Nova Scotia	2,833	2,529	+12.02
New Brunswick	2,128	1,981	+ 7.42
Quebec	12,552	11,644	+ 7.80
Ontario	31,336	28,835	+ 8.67
Manitoba	3,425	3,186	+ 7.50
Saskatchewan	4,524	4,337	+ 4.31
Alberta	5,133	4,565	+12.44
British Columbia	4,805	4,435	+ 8.34
Total	67,159	61,879	+ 8.53

*Imperial gallon equals 1.2 U. S. gallons

Nebraska Jobbers Renew Tax Refund Fight

LINCOLN, Neb., Nov. 13.—Nebraska jobbers continue to seek a refund on the "Million Dollar" gas tax collections under the unconstitutional social security law, and this week took further action to prevent the fund remaining with the state.

A special session of the legislature is engaged in writing a new social security law. The maneuver was appropriation of the "Million Dollar" fund to the general fund, then to the new social security law, through laws passed at this special session.

The "Million Dollar" fund comes from the 1 cent gasoline tax collected from March to September to finance Nebraska's social security act in matching federal aid on old age pensions and relief. Last fall the law was declared unconstitutional by the state Supreme court. More than $1,000,000 was collected.

Jobbers started action to recover funds paid under the 1-cent gasoline tax levy, contending the tax was on the importer of motor fuel. The attorney-general contends the collections should remain with the state, as the money could not be returned to the consumer. The case has been taken under advisement by the Supreme court.

Four oil companies this week went to the Supreme court asking that the appropriation laws of the special session on the "Million Dollar" fund be declared unconstitutional, and that the state be enjoined permanently from enforcing the acts.

The companies, acting for themselves and other jobbers, are the Donnelly Oil Co., Pawnee City; Arlington Oil Co., Arlington; the Davis Oil Co., Cozad; and the Farmers Elevator Co., Palmyra.

Truck Owners Pay Heavy Taxes

NEW YORK, Nov. 16.—State taxes on gasoline comprise more than one-half of the tax bill paid annually by motor trucks, according to information contained in "Motor Truck Facts", published by the Automobile Manufacturers Association for 1935.

Truck operators paid an estimated $154,170,000 in state gasoline taxes in 1934, against $71,852,000 for registration fees. The total tax bill was $308,828,000 which also includes the federal gasoline taxes paid.

Truck operators of New York state paid a gasoline tax bill of $14,322,192 for 1934, the book reveals, while Texas and Pennsylvania truck operators paid $13,576,560 and $10,320,768 respectively. It estimates the farmers use 26.6 per cent of all motor trucks.

The book indicates that 80 per cent of trucks are one and one-half tons capacity, or less and that the average load of interstate trucks is slightly more than two tons.

To Cut Freight Rates

TULSA, Nov. 16.—A freight rate reduction from several Oklahoma points is scheduled for Tulsa, Muskogee and Ponca City Nov. 16. The reduced tariff affects shipments of casinghead from the Seminole area, which includes Asher, Earlsboro, Holdenville, Lima, Pearson and Wewoka. From these points to Tulsa and Muskogee, the freight rate was reduced from 10.5 cents to 9.5 cents per hundred pounds. Shipments from the Seminole area to Ponca City Nov. 16 will take a 10.5-cent per hundred rate. This represents a reduction of 3 cents a hundred pounds. These rates are effective on the Rock Island lines.

Local reductions were made on the Frisco lines Oct. 19.

THE OIL INDUSTRY EXCHANGE

Wanted to Buy

GOOD USED SEMI-TRAILER wanted, with 1500 to 2000-gallon tank. Would consider individual units. What have you? Address P. O. Box 656, Wayland, N. Y., Steuben County.

U. S. MOTOR GASOLINE WANTED

Want to Buy—2,000,000 to 5,000,000 Gallons of U. S. Motor Gasoline, F.O.B. Tanker, Eastern Seaboard.

Address Box 272.

For Sale

BULK PLANT and 4 retail stations for sale. ½ million gal. business. Can be raised to 1½ million. 80,000 gal. storage. On railroad and barge canal, between Rochester and Syracuse, N. Y. Address Box 273.

WHOLESALE-RETAIL GASOLINE-OIL BUSINESS.

Modern equipped 7-tank bulk plant, storage 92,000 gal.; warehouse; 4-drive filling station, modern equipment. Center of town. 2 tank trucks. Station leases in Madison, Wis., equipment, etc. Now operating in Dane Co., Wis., including Madison. Estab. 9 years. Owners retiring.
Sun Prairie Home Oil Co.,
Sun Prairie, Wis.

ADVERTISEMENT—CALL FOR BIDS to purchase Royalty Oil and Royalty Gasoline Accruing to the United States from the Salt Creek, Wyoming, Oil Field. Sealed proposals, in duplicate, will be received in the office of the Secretary of the Interior, Washington, D. C., on or before noon December 2, 1935, from responsible bidders for the purchase, beginning January 1, 1936, of royalty oil and royalty natural or casinghead gasoline accruing to the United States from Government lands in the Salt Creek, Wyoming, oil fields. Detailed specifications on quantities offered for sale, required form of bids, deliveries, volume measurements, gravity determinations, bond requirements, and action on bids, should be obtained by prospective bidders from the Director, Geological Survey, Department of the Interior, Washington, D. C., the Supervisor, U. S. Geological Survey, Casper, Wyoming, or the Register, U. S. Land Office, Cheyenne, Wyoming. Sealed bids are to be submitted to the Secretary, Department of the Interior, Washington, D. C. pursuant to the specifications, the envelope to be marked plainly "Bid on Salt Creek Royalty Oil (Gasoline)." No bid received after the time herein fixed for submitting bids will be considered. (Sgd) HAROLD L. ICKES, Secretary of the Interior.

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Burner Distributor Invites Prospects To Hear Sales Talk—and Dance

WASHINGTON, Nov. 16

AN "EXPERIMENT in mass selling" was tried here Nov. 15 by the Automatic Burner Corp., of Chicago, and was declared a great success.

Invitations to a "Thanksgiving Party" at the Mayflower hotel were mailed out to some 7700 persons on the prospect list of John P. Agnew & Co., local distributor of ABC oil burners. They knew in advance that they were going to have to listen to sales talks but about 2800 attended.

Sam Agnew briefly sketched the history of his company's 78 years service in coal and later burner and fuel oil business, and then introduced J. H. Hirsch of Chicago, president of the ABC Co. In a homely, humorous vein, Mr. Hirsch told how his company started, injecting personal reminiscences which won sympathetic response from the audience.

A sales talk followed but was immediately interrupted by the entrance of a policeman with a traffic violation ticket for the ABC host. It turned out to be Officer Nester, well-known as the "singing cop," who obliged with several old time songs.

The sales talk was resumed but again interrupted; this time a cardboard facsimile of an oil burner on the stage. To the surprise and delight of the audience, the burner, in the sonorous tones of the city's best-loved radio announcers, began to talk back to its interlocutor, Mr. Townsley of the local ABC office.

In this manner, the advantages of oil heating and selling points of the ABC burner were put across. When the audience had about decided it must have an oil burner, Leslie Baker of the FHA came forward and explained how it can be done, with payments spread over three years. Another entertainment number followed.

Ralph E. Caldwell, New York merchandising counsel, closed the program with a talk frankly discussing the purpose of the gathering. The audience then moved over to the dining room for refreshments, returning for three hours of dancing to Meyer Goldman's orchestra which was interspersed with the drawing of lucky ticket numbers for prizes.

Salesmen reported that the guests seemed eager to look over the oil burners on display in the hall and volunteered their names and addresses, asking that a salesman call to discuss an oil burner for their homes. In the company's office the morning after, the telephone was ringing almost constantly with the guests calling up to thank the company.

The ABC company has staged similar parties in Philadelphia, Baltimore and other cities. Follow-up parties which will be restricted to users only are being planned.

To the observer, the surprising part of the event was the grateful goodwill manifested by the guests. Many had never been in the Mayflower Hotel before while some of the older folks had not attended a dance in years. The hall began to fill half an hour before the scheduled time. Of course, many did not come until after the sales talk was over, but the hall had difficulty holding those who did arrive in time.

General Smedley D. Butler was guest of honor at the recent dinner of the Oil Trades Association of New York, Inc. The view of the speakers' table above shows (left to right) Charles L. Jones, vice-president, Socony-Vacuum Oil Co.; Fayette B. Dow, general counsel, National Petroleum Association; General Butler; Joseph C. Smith, Smith-Weihman Oil Co., secretary of the association; Rudolph G. Sonneborn, L. Sonneborn Sons, Inc., president of the association; and Charles Jones, president of the Philadelphia Oil Trades Association

Davis Succeeds Frolich

NEW YORK—G. H. B. Davis has been named director of the Esso laboratories of the Standard Oil Development Co., Elizabeth, N. J., to succeed Per K. Frolich, who was made chief chemist of the Development company.

H. W. Fisher, formerly assistant manager of the Esso Marketers sales engineering department, will succeed Mr. Davis as assistant director of the laboratories.

Plan Many Oil Meetings During Exposition

TULSA, Nov. 16.—A large number of oil associations have been invited to hold meetings in connection with the International Petroleum Exposition here next May 16 to 23, according to W. B. Way, general manager. The exposition has offered assistance in making arrangements and helping in any way it can.

Two of the largest meetings already planned will be the mid-year meeting of the American Petroleum Institute and the Independent Petroleum Association of America.

The A. I. M. E., petroleum division; Purchasing Agents association; Safety meet, and a marketers meeting are other gatherings being planned but not definitely scheduled.

In the past between 20 and 25 major association meetings have been held during the show.

Pacific Coast Tanker Shipments Lower

LOS ANGELES, Nov. 14.—Total tanker shipments of petroleum products from Pacific Coast territory averaged 161,287 barrels daily in October, as compared with 184,392 barrels daily in the corresponding period last year.

Crude oil shipments last month totaled 51,001 barrels daily, against 23,158 barrels daily in October, 1934, according to preliminary estimates prepared by the Oil Producers Agency. The whole of this increase was in shipments to Pacific foreign ports.

A decline of approximately 30 per cent in shipments of gasoline in October, 1935, as compared with October, 1934, was due to lessened demand from all ports, including Pacific foreign, Atlantic foreign and intercoastal. Total shipments of this product last month were 40,958 barrels daily, as compared with 60,528 barrels in October, 1934.